THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1618.] LONDON, MAY 15, 1894. [46TH YEAR. PRICE 6d.

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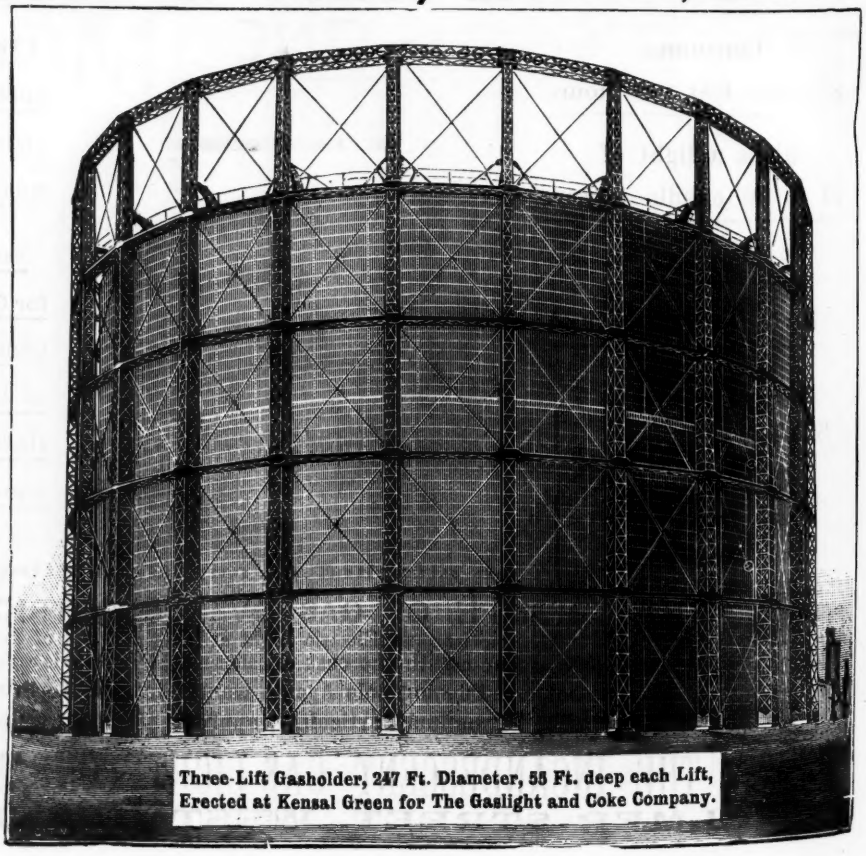

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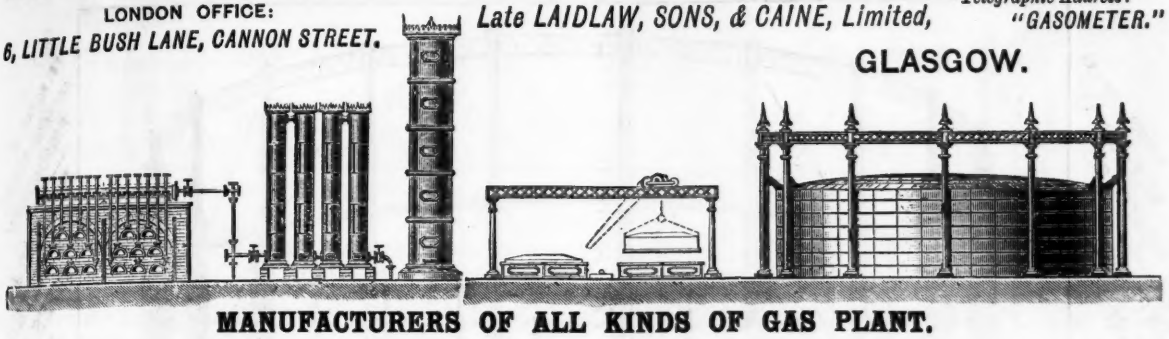

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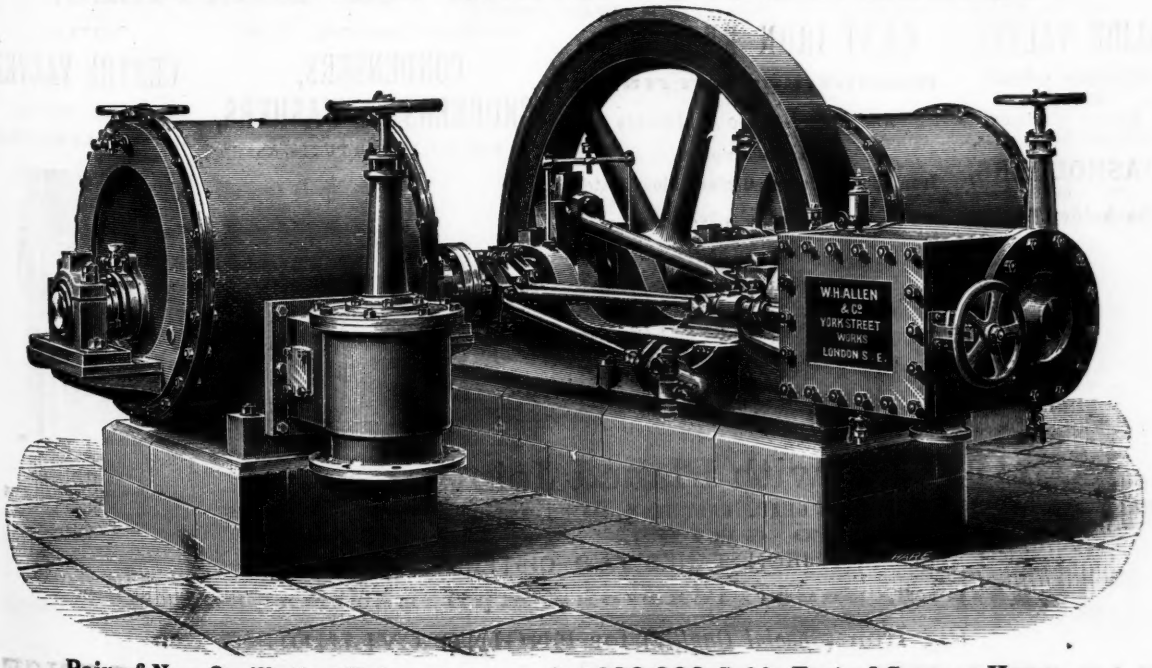

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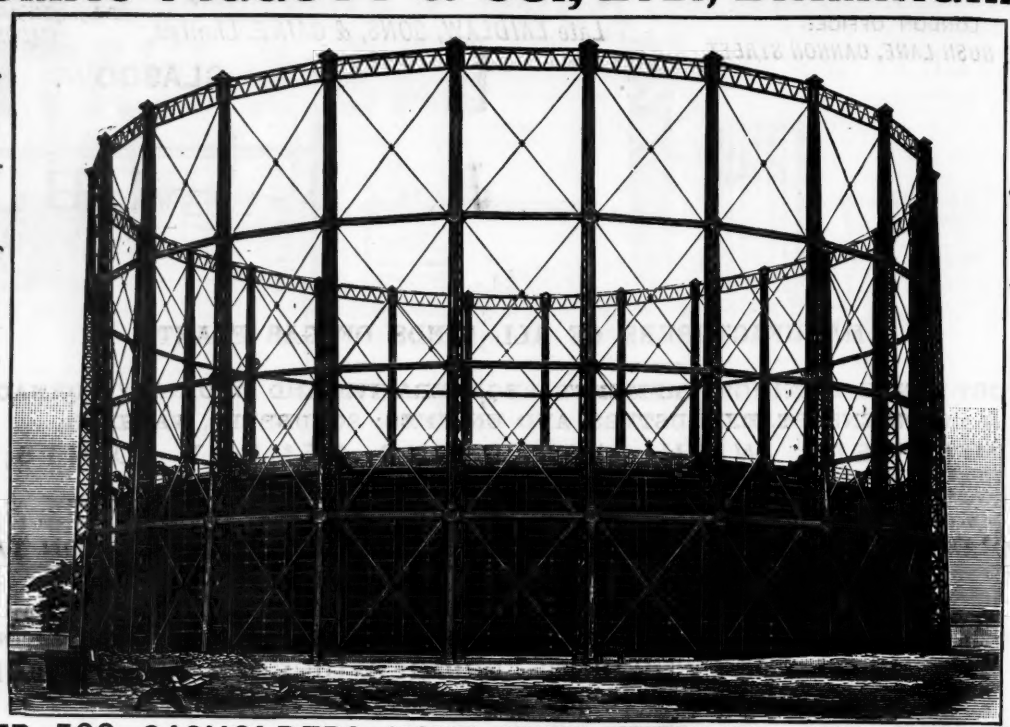

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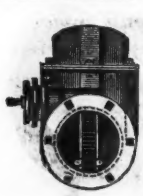

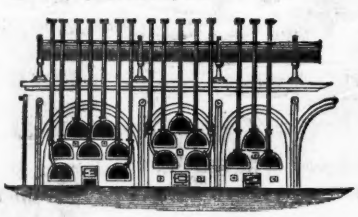

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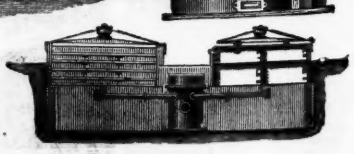

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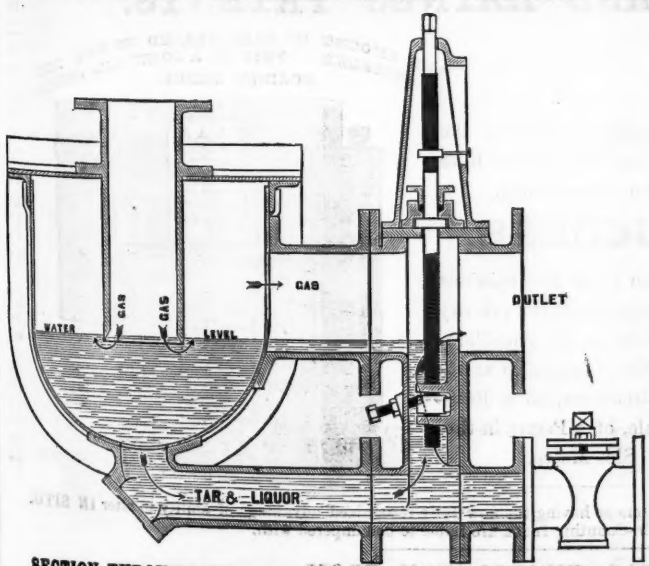

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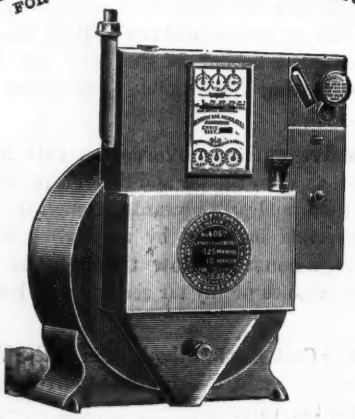

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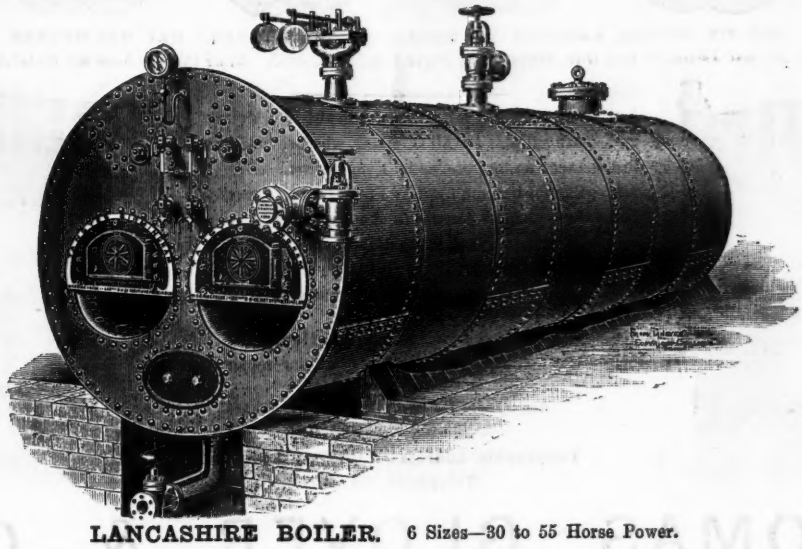

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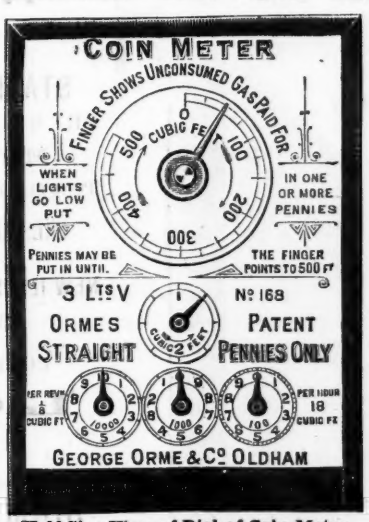

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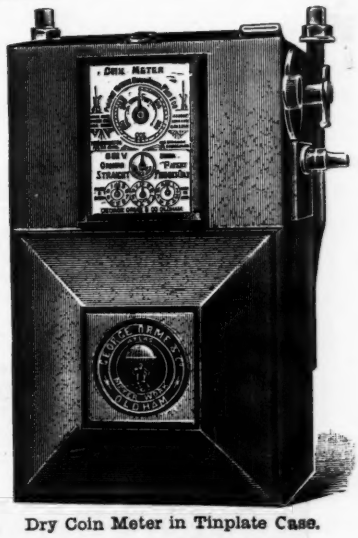

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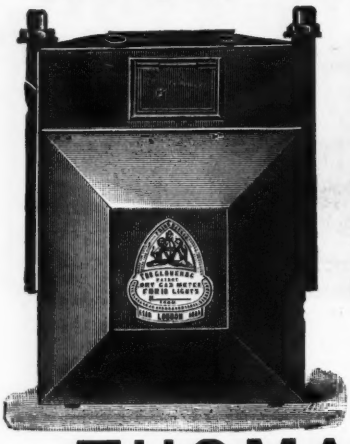

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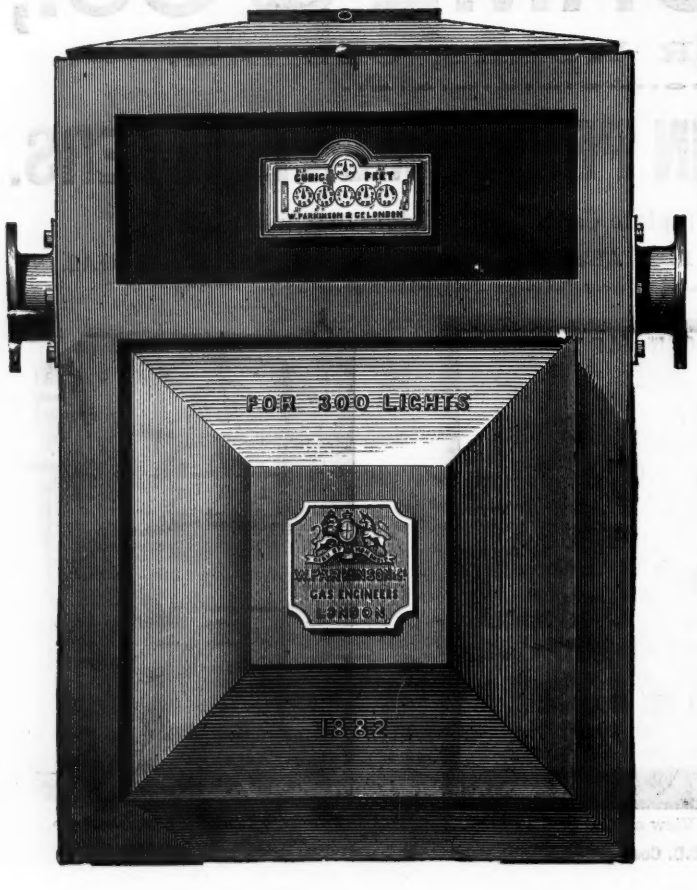

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[See also Advt., p. 936.

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 15, 1894.

The Meeting of the Institution of Gas Engineers.

IT is pleasant to be able to congratulate the Institution of Gas Engineers on their third summer meeting, which was held, according to programme, at the Institution of Civil Engineers, and turned out satisfactory in every way. The President—Mr. Alfred Colson, of Leicester—amply fulfilled the high expectations that had been formed of him in this, to him, new capacity. His Inaugural Address was a good example of the clear and succinct expression of individual knowledge, which is what such compositions should be; and his conduct in the chair was everything that could have been desired. The matter of the address is discussed elsewhere; and we have therefore now only to put upon record, in general terms, the fact that it met with the appreciation it so fully merited. The papers read at the meeting, with scarcely an exception, were of a high class; and while it is to be regretted that too much, by way of reading and discussion, was attempted in the time at disposal for this purpose, this is so common a failing of scientific and technical congresses everywhere as to partake of the nature of original sin, and consequently to be regarded as ineradicable. The truth of the matter is, of course, that all governing councils of such bodies are careful to provide plenty of material for debate, and for inclusion in their published Transactions; while they have no means of knowing in advance precisely how long it will take to dispose of every item on the programme. In a general way, but little harm, if some small annoyance and disappointment, ensues from lapses of this kind; but it cannot be regarded as other than a public misfortune that, in this instance, discussion had to be stifled in regard to precisely such topics as needed to be thoroughly threshed out. We allude more particularly to the paper on the oxy-oil gas experiment at Huddersfield. Circumstances which need not be detailed have lent to it a peculiar interest which in some respects transcends that attaching to any other subject brought before the meeting; and it is little short of calamitous that the exigencies of the passing hour should have operated in letting off Mr. W. R. Herring's statement with so little criticism. But our "Correspondence" columns are open to all who desire further opportunity for discussing this or any other of the communications laid before the meeting. As a matter of fact, the three papers upon carburetting, which had to be discussed, after a fashion, together—only a short half hour being available for the purpose, inclusive of the authors' replies—went a good way to answer one another. Certainly, when the contents of one are in question, it will not be safe to ignore the rest.

The attendance at the meeting was good throughout; and the interest of the proceedings was maintained to the very last. The members of the Institution had manifestly gathered in Westminster for business; and they were not inclined to "skip" any promising paper. The quality of the discussions was, on the whole, fair; but it cannot be said that the device of distributing prints of the papers had any noteworthy effect upon the oratory of the various speakers. This was possibly because none of the papers really debated happened to be difficult to follow.

A gratifying feature of the meeting was the indication offered at the dinner, and on other occasions, of the willingness of the heads of that great organization, the Imperial Continental Gas Association, to accord their support to the Institution. It is eminently desirable that English gas engineers serving upon the Continent should have frequent opportunities of meeting their British colleagues. The benefit of such companionship is mutual. We have always been ready and willing to acknowledge the value of the part played in the development of the gas industry by foreign engineers. It was the JOURNAL which "imported" the regenerative gas-furnace for retort-settings; and no British technician is likely to forget the great debt the industry owes to Frederick Siemens, Dr. Auer von Welsbach, and M. Coze. Yet, as Sir Julian Goldsmid said at the dinner, England is the mother country of the industry; and we take leave to declare that it is in England that the industry has its fullest scope. It must therefore be of advantage to the expatriated gas engineer to touch his native earth time and again; so renewing his strength, while at the same time enlightening home-staying professional brethren by making them feel the current of foreign opinion and practice.

In speaking for the Institution at the dinner, the President uttered words of kindly wisdom which we regret to feel are not likely to reach, in their integrity, farther than the company he addressed, seeing that it is not our custom to report after-dinner speeches. By a happy inspiration, Mr. Colson was moved to observe how he had learnt with much pain that some gas engineers throughout the country have the idea concerning the Institution that it claims to be a sort of "Upper House" of the profession, and that its

members regard themselves as "superior persons." This notion he mentioned only to repel as quite unfounded; and he scouted it in the strongest terms of condemnation as likely to be injurious to the prospects of the organization. He went on to aver that the constitution of the Institution is essentially democratic; and he pleaded that, so far from being exclusive, its ranks are open to all working members of the gas engineering profession whose credentials satisfy the not very exacting standard upheld by the Council. To tell the truth, it was high time that such an avowal should be made on behalf of the ruling spirits of the Institution, who have been more than suspected on all sides of that very failing which Mr. Colson repudiates for himself, and by repudiating condemns. Whatever might have been the idea at the start, the Institution of Gas Engineers has lost all reasonable excuse for holding itself out as possessing a different mission from that of any other society of the kind. It now bids for support against The Gas Institute; and it has no other fundamental distinction, as compared with the latter, than such as appertains to the circumstance of its having started in life without certain of the troublesome and objectionable weaknesses inherited by the Institute from the "beanfeast" period of its existence. It is a more manageable and a more businesslike body than the old Institute; and if its managers exert only a decent show of tact in their public and semi-public dealings with their whilom colleagues, and keep up the quality of their technical work, they will infallibly attract to themselves the best workers among those who have not yet left the older organization. As it is, if one might pose the hypothetical case of a gas manager who had not previously joined a national technical organization, but wished to enrol himself in that from which he could derive the most good, it would not be very difficult to indicate which of the two societies such a man would prefer; but it is not too much to say that a continuance of the Institution in that attitude which it has appeared to hold during the past year or two would be fatal to its prospects of doing good, either to its members or to the larger technical world without.

Reduction of Price by the South Metropolitan Company.

THE announcement, sprung on an unprepared Metropolis in last Thursday's newspapers, of a reduction of 1d. per 1000 cubic feet in their price of gas by the Directors of the South Metropolitan Gas Company, is one of those bits of news which possess greater significance than appears on the surface. If the thought of taking this step had been long in the minds of the Directors, the secret was thoroughly well kept; and it is certain that nobody who heard Mr. George Livesey, the Chairman of the Company, read his paper on the question of labour in gas-works at the morning session of the Incorporated Gas Institution on Wednesday, entertained the faintest suspicion that he was going off to the meeting of his Board the same afternoon with the intention of preparing such a surprise for the people of London. But next day the announcement was matter of common chatter where, for the time being, gas engineers did happen most to congregate. And, as if by common consent, the one aspect of the news which was most regarded was that of the effect it might have upon The Gaslight and Coke Company, who will be compelled to follow suit to their private consumers south of the Thames, and to public lighting authorities in all parts of their district. The general opinion seemed to be that the larger Company would be bound to take up the challenge, even to the temporary discomfort of the shareholders. It is at least certain that, unless something of the sort is done, and that speedily, the enemies of The Gaslight and Coke Company will rage yet more horribly against them. We have heard some feeble folk argue in the familiar way that the latest action of the South Metropolitan Directors is "rash," and that their previous selling price of 2s. 5d. per 1000 cubic feet was "cheap "enough" in the circumstances. In answer to such critics, it should be sufficient to suggest that probably the South Metropolitan Directors know their own business best, and that the announcement in question probably means no more than that they have succeeded in buying coal for the year upon favourable terms. As to the price of gas being "cheap enough," the people who use this phrase simply indicate in this way that they entirely fail to grasp the true meaning and the operation of the sliding-scale. Gas is surely never cheap enough while it can be sold for less money; and we believe the South Metropolitan Directors so fully realize this principle, that they would be only too delighted if they could sell their gas for eighteenpence per 1000 cubic feet. It is possible to urge with some reason that their action is not very considerate of the exigencies of the Chartered concern; but the latter has never been so well disposed towards the former that the South Metropolitan Directors should trouble themselves in the smallest degree to suit their neighbour's convenience. The Horseferry Road has been very high and mighty in its dealings with the Old Kent Road; and it would be only in accord with human nature, which is never wholly driven from the breast even of a gas director, if the Old Kent Road were to give the other establishment a "nasty one" in return. We believe, however, that the present matter has nothing to do with the actual or possible existence of animosity between the two Companies, but arises merely out of the natural desire of the South Metropolitan Directors to get back as soon as possible to the conditions which existed when they entered into their great profit-sharing compact with their workpeople. It was a severe strain upon this arrangement when the Directors were forced to raise the selling price of gas, and consequently to cut down the workmen's proportion of "profit." The strain was borne, however, and without a murmur. Likewise the consumers paid their heavier bills with exceptional cheerfulness, born of the belief that the higher price of gas would only be temporary, and that the Directors would seize the first opportunity that presented itself for returning to the previous state of things. This confidence is being justified—that is all. But the fact of the operation being regarded as a blow for another London Gas Company shows how unsatisfactory is the present system of determining the prices that different parts of the same town pay for gas.

The Plymouth Bill in Committee.

THE proceedings in Committee on the Plymouth and Stonehouse Gas Bill, reported in another part of the JOURNAL, were of some general importance, and possessed much interest so far as they went. The opposition to the Company's demands embraced the two elements of the local and the universal. Much more play was made with the former, especially in respect of the peculiarities of the Company's capital account. What might have been the most serious attack, however, if it had been well supported, was that directed against the Company's initial price, which was asserted to be too high. The shortsightedness of the request for a revision of the initial figure was exposed by Mr. George Livesey, who carried the Committee with him in his brief, but unanswerable, defence of the integrity of the sliding-scale. There should have been a better fight over the question of the illuminating power, which is now 14 candles, and was desired to be raised to 16 candles. As we anticipated, the Committee favoured what they considered to be the happy mean between these two figures, and made it 15 candles, tested, be it remembered, on the works—a most important qualification. In arriving at this decision, the Committee may be said to have "wrought better than they knew," inasmuch as they saved the Plymouth people from having to pay more for their gas in future than they have hitherto done, by way of premium upon the doubtful advantage of receiving richer gas than their accustomed burners are capable of burning to advantage. It cannot be truly said that this important question was completely handled before the Committee; the Counsel engaged upon it being evidently unable to grasp the essential points involved. Hence the technical evidence reads disappointingly thin. On the whole issue, both the promoters and opponents of the Bill seem to have fair reason for satisfaction with the result of the Select Committee's deliberations. In future references to this precedent, the proceedings upon the Crystal Palace District Bill of last year should be studied in connection with it, for both measures belong to one general scheme of reform in Gas Company administration; and the Plymouth Bill is essentially the Crystal Palace District Bill amended in the light of a year's experience.

The Crossing of the Curves.

OUR respectable, if ponderous contemporary, the *Engineer*, has discovered a mare's nest of extraordinary beauty in the supposititious recoil of the gas industry, more particularly in London, before the advance of electric lighting.

This brilliant exploit naturally attracted the sympathetic attention of the *Electrician*, which reproduced the "find" in its issue of the 11th inst.; and the argument based upon it was gaily pushed home on the following day by the *Pall Mall Gazette*, which, with the light-hearted confidence of the ordinary newspaper when dealing with a technical matter, jumped to the conclusion that it is "all up" with gas at last. The cheerful reflection offered upon this conclusion is that "the day when gas is finally abolished "for lighting purposes will mark one of the most impor- "tant sanitary reforms of the century." The truly wonderful origin of all this tissue of assertion and comment is the detection by the *Engineer* of the alarming fact that the quantity of gas sold in London in 1892 was only an increase of "rather less than 35½ millions" upon the sale for the previous year; while for last year the consumption of gas actually showed a decline. Meanwhile, the consumption of electricity for lighting has continued to increase; and so it is argued by the *Pall Mall Gazette* that the "crossing "of the curves has already set in, and that gas, for the "purposes of domestic lighting, is on the downward "grade." The *Engineer* reinforces its argument for the decadence of gas by quoting Professor Fleming as having stated at the Royal Institution the other day that there are now 700,000 incandescent electric lamps in use in the Metropolis; and although our contemporary is sufficiently wary not to assert that this lighting business is done at the expense of the Gas Companies, it is more plausibly contended that if the Companies had all this extra business to do they would be selling nearly 1100 million cubic feet more gas per annum than they do. The *Electrician* makes it 1400 millions. All sorts of meanings may easily be attached to a given set of figures; and we are not at all anxious to inquire which of the "calculating boys" has done the sum correctly. The truth is we regard all such exercises as fitter for the class-room or the lecture blackboard than for technical journalists. If gas is destined to be wiped out—perhaps blown out would be the more appropriate term to use—by electricity, it is a matter of indifference whether this is being done at one rate or at a slightly greater speed. It is quite true that the consumption of gas in London, taken as a whole, showed a check last year; but, on the other hand, two years ago the increase was so great that it was as much as the Companies could do to keep up with it. Ruin may have set in for the Gas Companies since 1891; but it is at least common prudence to exhaust obvious and immediate reasons for an observed effect before fetching others from afar. It is possible, of course, that if one were to seek into the gas and electric light statistics of some typical cities and towns in different parts of the United Kingdom, examples would be found where the "curves" show as yet no tendency to "cross." But taking only the case of London, where the demand for gas has admittedly been checked, what is the first thing to be noted? That the decrease has not been uniform over London; but that the highest-priced gas has suffered most. This means, if it means anything at all, that even in London there is a point at which people begin to talk of gas as being dear, and to economize accordingly. Again, it is known that while London continues to grow, the rate of increase is not regular, and that it has markedly declined during the past year or two, except in the southern suburbs, where gas retains more of its popularity, and is also cheapest. Then there are the bright weather of last year, the mild winter, and the ever-growing popularity of recuperative and incandescent gas-burners to take account of; to say nothing of the cheapest oil supply in Europe. Not until it has been shown that the recent check in the growth of gas consumption cannot be accounted for upon these grounds, shall we begin to think that the industry is in a bad way. Moreover, as we pointed out last week, the Electric Lighing Companies themselves are experiencing a falling-off in their rates of increase, amounting in the case of the Metropolitan Electric Supply Company to £10,000 for the past year. What would the *Engineer* and the *Electrician* have said if the revenue of a London Gas Company suffered in anything like the same proportion? It appears to us that when the Central Station Electric Lighting Companies are approaching so nearly to the point of saturation of their districts as to find their rate of increase dropping from 50 per cent. to about 10 per cent. per annum, it is hardly the truth to describe them as pushing the Gas Companies out of the competition for life.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, MAY 9 & 10, 1894.

Mr. ALFRED COLSON, M.Inst.C.E., President.

REVIEW OF PROCEEDINGS.

THERE was not a very large attendance of members of the Institution of Gas Engineers in the lecture theatre of the Institution of Civil Engineers, when the retiring President —Mr. John Methven—took the chair on Wednesday morning, and at once commenced the formal business of the meeting by moving the adoption of the report of the Council and the balance-sheet. The next incident was the presentation of the Scrutineers' report, showing an addition to the strength of the Institution of five members and two associates. Mr. Methven then retired in favour of the new President—Mr. Alfred Colson; but he was not allowed to subside into his place beyond the chair without receiving a cordial vote of thanks for his services to the Institution during his year of office. The hall had filled to a more satisfactory degree by the time the President rose to read his Inaugural Address, the text of which, with the accompanying tables, will be found elsewhere.

The President's address was thoroughly characteristic of the man. When he sat down to compose it, Mr. Colson seems to have asked himself, not how brilliant a piece of rhetorical fireworks he could produce, but how he could best serve his fellows of the Institution and the profession. And it must have come to him as an inspiration that they would most likely prefer to anything else his talking to them about the conversion of residuals, seeing that he is one of the few men in England, not wholly committed to the commercial issue of the matter, who know all about the manufacture of sulphate of ammonia and the distillation of tar. He says himself that he is often asked questions on these topics; and when he finally decided to make a clean breast of his experience in these lines, he must have done so with the feeling that henceforward it should be possible to exorcise the "inquiry-circular" fiend with a copy of his address. Mr. Colson has done a great deal at Leicester in regard to working up his residuals; but hitherto he has not been free to say exactly what he has been doing, because he started operations upon the strength of other people's experience. We believe that at the period of the inception of the Aylestone products works, Mr. Colson put himself in communication with, and was the recipient of much confidential information from, gentlemen in the trade who had a natural objection to having their data handed on to innumerable third parties. A sufficient period of time has, however, now elapsed for Mr. Colson to claim a right to speak at first hand upon these matters. How "the trade" will like his present outspokenness, remains to be seen; but there must be little enterprise in the private traders if they are capable of being frightened by anything which the official head of a municipal department can say. There may yet be secrets in the tar products industry; but there can be no mystery in any branch of a gas undertaking maintained as a part of the public municipal service.

Subject to the foregoing remarks, we are enabled to describe the portion of Mr. Colson's address which relates to the working of the Aylestone residuals factory as the most complete and altogether satisfactory statement of the results of the conversion of tar and ammoniacal liquor as part of the ordinary working of a gas undertaking that has yet seen the light. It is not for us to criticize the technical results achieved by Mr. Colson; and we can only say that his business methods must be remarkably good. In connection with some products works that we wot of, rumour has it that unintelligent dealing at head-quarters wastes more money than the best technical management can make. It argues boldness on Mr. Colson's part to so freely expose his results of both kinds.

In view of the prevailing popular feeling on the subject, it is important to note that Mr. Colson has adopted the

eight-hour day in his chemical works—not, be it remarked, as a concession to the men, but rather against their opposition in the first instance. He reports that, in his opinion, this method of dividing the day might be advantageously adopted in all works of a similar character, and working under like conditions. The most striking statement of this section of the address, however, is the declaration that the produce works take 2d. per 1000 cubic feet off the price which but for them would be charged for gas in Leicester. The conditions are in some respects exceptional; and Mr. Colson concludes that, while it must be generally advantageous for every gas undertaking to make sulphate of ammonia, the distillation of tar is not to be lightly entered upon in connection with gas manufacture. All this portion of the address is weighty and informing in the highest degree; and it will for some time to come constitute the text-book of the subjects treated.

Mr. Colson next proceeds to discuss, with the same regard for facts, the influence of the use of gas stoves and engines upon the gas consumption of a large town. In connection with this topic, he makes a statement calculated to derange the conceptions of the old-fashioned gas manager. By way of conducing to the success of every gas-engine put down, it is Mr. Colson's practice to ensure the adequacy of mains and services, and to keep up a good day pressure. He has accordingly been led to abandon the well-known "golden rule" of gas management applying to the last point, and has increased the day pressure in Leicester from 10-10ths to 19-10ths. Wonderful to relate, he does not find that this change of principle has led to any increase in the quantity of unaccounted-for gas, which is down to 2·67 per cent. for the whole of the district. This fact speaks volumes for the condition of the distributing plant. Passing on to the consideration of the effect of cooking-stoves upon the undertaking, Mr. Colson brings out the somewhat unexpected truth that, at any rate in Leicester, which is a manufacturing town, the gas-engines bring better business than do the stoves. It is not that the stoves are anything but good friends to the gas manufacturer, or that Mr. Colson personally does not believe in them; indeed, he is a liberal and open-minded patron of every apparatus of the kind that has claims upon a gas manager's respect. But he finds the engines more profitable, and devotes the more praise to them inasmuch as they have not been pushed by the special aids to popularity so freely extended in the interest of gas cooking and heating.

The address concludes with some general observations upon the policy to be pursued by gas managers in view of the state of the coal trade, in the course of which Mr. Colson endorses the arguments we have used in the JOURNAL to deliver the gas industry from the responsibility sought to be forced upon it for keeping down the value of coal. Mr. Colson finishes by admitting that, in preparing his address, he chose to confine himself to those subjects "to which circumstances have called him to give special attention;" and he has his reward in the knowledge that he has enriched the Transactions of the Institution with a sterling piece of technical teaching, the value of which it would be difficult to appraise too highly.

The vote of thanks to the President for his address was moved in sympathetic terms by Mr. Livesey, seconded by Mr. Trewby, and carried by acclamation.

The meeting then settled down to hear Mr. Livesey upon "The Relations of Capital and Labour in Gas-Works." The paper was worthy of the author; but it cannot be said that either it or the discussion that followed it, and was prolonged until every member present had had ample time and to spare for any expression of opinion he might have wished to put upon record, completely exhausted the subject. Mr. Livesey dealt with the matter with almost exclusive reference to the concrete examples with which he has been indentified as founder. His motives in instituting these interesting experiments are excellent; and his success seems in every respect to be unquestionable. It cannot be argued, however, that what he calls "profit-sharing" is soundly based upon a principle susceptible of general application, which is perhaps the main reason why other gas-works administrators are so far content to admire his example without copying it. Strictly speaking, both the South Metropolitan and Crystal Palace District Companies' arrangements of this kind are only colourable imitations of the real thing, founded upon a wholly artificial basis. There is no sort of connection between the rates of wages paid in gas-works and the selling price of gas. In both of the instances which supply Mr. Livesey with his text, the Directors have assumed quite arbitrarily a starting-point from which an advance upon their previous wages rates may be calculated. It is with no desire to depreciate the merit of their action that we venture to point out that Mr. Hunt laid his finger upon the weak part of this scheme, or anything similarly based, when he remarked, in the discussion upon Mr. Livesey's paper, that in his case the adoption of such a device would mean turning the existing maximum rates of wages into minimum rates. Of course, this may well be worth the doing. On this head we offer no criticism. But the truth is as Mr. Hunt put it; and no appreciation of Mr. Livesey's plan that did not realize this feature would be quite candid. The only other valid contribution to the elucidation of the subject was that of Mr. Denny Lane, who suggested that a truer kind of profit-sharing would be some scheme for making the gas workers' bonus depend upon a reduction of the labour costs of gas making. This is a very plausible suggestion; and it is not to be made light of, so far as it goes. It would be comparatively easy, in theory, to put it to a set of gas stokers, say, that if they could reduce the cost of carbonizing a stated weight of coal, they should have an addition to their pay; but it is a sufficient reply to this that it is not profit-sharing, but piece-work. To put the difference in a single word, and even in a letter, it is not "piece-work" with the "i" that is in question, but "peace-work" with the "e." Mr. Denny Lane will surely see this point.

Two diametrically opposed ways of controlling gas workers, both altogether outside the question of profit-sharing, came out in the course of the discussion. Mr. Trewby spoke, and spoke well, from the somewhat delicate position in which he was placed in this regard; but all that he could advance with respect to the practice of The Gaslight and Coke Company showed that the men are supposed to be kept in good order by the presence in their midst of certain buildings constructed *in terrorem*. Mr. Foulis, on the other hand, gives his men a bonus pure and simple for the faithful performance of their engagements; and he finds they esteem it a privilege to be permitted to sign agreements for service over comparatively prolonged periods.

A good deal was made by various speakers, and in particular by Mr. John West (who took part in the discussion upon the President's invitation), of the incompatibility of any possible scheme of profit-sharing in gas making with municipal ownership. This is as may be; but Mr. Foulis's experience goes to show that municipalities can yet make it worth while for workmen to serve them with more than the perfunctory rendering of duty. In one respect at least municipalities might easily take a leaf out of the South Metropolitan book. We allude to the matter of providing a means of investment for their servants' savings. The creation of small capitalists may or may not be a safeguard against Socialism. But the encouragement of thrift is a good thing in itself; and the more the working classes can be educated and assisted into becoming shareholders or bondholders of their company or municipality, as the case may be, the steadier they will be. This is a course that has long been warmly supported in the JOURNAL.

We must not devote more space to the discussion of the various weighty problems arising out of Mr. Livesey's paper, but pass on to the other business of the meeting. The afternoon of Wednesday was appropriated to the reading and discussion of the two useful, but not very debateable, structural or engineering papers by Mr. Meunier and Mr. Bryan Donkin respectively. Both contributions will read well in the published Transactions of the Institution; but neither calls for detailed comment here. A curious point arose unexpectedly out of Mr. Donkin's paper. The author mentioned the remarkable fact that at Winterthur, and some other places in Switzerland, it is the practice to distribute two qualities of gas through the same mains—a gas of low illuminating power by day for the supply of engines, stoves, &c.; and an enriched lighting gas by night. The statement came before the meeting as a piece of news; but, to the general surprise, Mr. J. Ferguson Bell, of Stafford, admitted, in the course of the discussion which followed the reading of the paper, that this "Swiss mixture" is closely paralleled in Stafford, where it has lately become the custom to sell

15-candle day gas at 2s. 3d. per 1000 cubic feet, carburetted by night up to 18-candle gas, for which 2s. 9d. per 1000 cubic feet is charged.

Of course, the idea of differential prices for day and night gases is not novel, nor is 6d. per 1000 cubic feet an extraordinary difference to be made, in the case of a manufacturing town, between the price of gas for engines &c., and that sold for lighting purposes. What is new in the Stafford plan is the correspondence between illuminating power and price, which was evidently suggested by the adoption in this town of a method of carburetting the gas as sent out according to the principle first made practically successful by Messrs. Maxim and Clark. Starting with this principle of carburetting, Mr. Bell's differential arrangement appears perfectly obvious; but he is not on this account the less entitled to credit for putting it into operation. Still, the arrangement accentuates the fact that the enrichment of gas from 15 to 18 candles costs, in the case of Stafford, after the rate of 2d. per candle—a point which is not likely to be overlooked just now, when the policy of enrichment is being carefully considered upon all its merits.

The dinner of the Institution on Wednesday evening was a great success. Distinction was lent to the gathering by the presence of Mr. William Woodall, M.P., and of Sir Julian Goldsmid, M.P., who has during the present session of Parliament made such good use, in the public service, of that genius in the transaction of business and in the management of men which have redounded much to the advantage of the Imperial Continental Gas Association. Mr. John West, President of the Incorporated Gas Institute, was also present as a guest of the Institution.

On Thursday the technical business began well with Mr. Frank Livesey's paper on "Stoking Machinery *v.* Inclined Retorts," in which the comparison between the two systems of carbonizing coal was well and justly drawn. This eminently useful paper was followed by Mr. Tysoe's description of the working of the Foulis-Arrol power retort-stoking machinery at East Greenwich; and the result of the morning session was to establish a record of the actual state of carbonizing practice in large works which cannot fail to be most helpful to the profession at large. The afternoon was devoted to the three carburetting or enrichment papers of Messrs. J. Ferguson Bell, S. Glover, and W. R. Herring. It is quite unnecessary, even if it were to be desired, that we should say much here about the matter of these contributions. They must speak for themselves and for their authors; and readers of the JOURNAL will not be slow to form their own opinions respecting their absolute and comparative values. It is greatly to be regretted that time did not permit of their being discussed at anything like proper length; for it is inevitable that the brevity of the reported debate will, after a lapse of time, be open to the interpretation that there was little to say respecting the positions taken up by the writers. This view would be a sadly mistaken one; for, as a matter of fact, all the papers aroused much interest, and would have elicited many questions if the occasion had allowed free scope for criticism.

We would offer to the Council one general suggestion. It is that prints of papers should be complete with all necessary tables; and that, when tables or diagrams are accepted for display before a meeting, it should be a *sine quâ non* that they should be upon a sufficiently large scale to be read from all parts of the place of meeting. Neglect of this condition led to very regrettable waste of time on Thursday; and it must always defeat the object of such aids to the comprehension of an author's meaning.

Time was cut so short for the Institution, that the indispensable complimentary votes and votes of thanks were hurried through at railroad speed. Considerable satisfaction was felt when it was announced that the autumn meeting would be held at Leicester; and it did not need the President's promise to assure the members that nothing would be spared to make this gathering a conspicuous success.

Friday's excursion to Reading and the River Thames really deserves a fuller record than our space permits for the purpose. A goodly party of members left Paddington in saloon carriages attached to the 10·5 morning train; and they were received on arrival by Mr. E. Baker, the Engineer, and some of the Directors of the Reading Gas Company. Most of the visitors walked through the Castle Gardens to the gas-works, where they passed a couple of hours in inspecting the model plant and buildings that now supply the town with gas. Mr. Baker's works are a proverb for completeness, elegance of design, and the intelligent application of the best means to the most advantageous ends. Reading has had three gas-works in its time; but it is safe to prophesy that the present station will never become old-fashioned, to say nothing of obsolete, while gas is made by the carbonization of coal. The splendid retort-house, with its labour-saving appliances for handling coal and coke, and its monumental retort-benches, was greatly admired; and the same appreciation was inspired by the whole of the arrangements of the works. Mention must, in fairness, be made of a really magnificent display of drawings of the station and the buildings, the work of Mr. A. D. Carter, which were exhibited after the gas-works themselves had been gone over. A thoroughly good luncheon, provided by the Directors of the Company, ended the morning's programme. The rest of the day was appropriated to a most enjoyable launch trip down the river to Maidenhead. The pleasure of the afternoon was enhanced by the thoughtfulness for strangers to the river which inspired Mr. Arthur H. Cave, the Secretary of the Reading Gas Company, to prepare a neatly-printed booklet recounting the "Historical and Legendary Associations of the River between Reading and Maidenhead," a copy of which was presented to every one of the Company's guests. The hospitality of the Reading Gas Company is well known to be of the good old English kind; but it must be conceded that they surpassed themselves upon this occasion. Mr. J. O. Taylor, J.P., the Chairman of the Company, who, as he told his guests at the luncheon, has held this position ever since the Crimean War, accompanied the party throughout, and, by his overflowing geniality, made it evident that he and his colleagues were as unaffectedly glad to have the Institution at Reading as the members unmistakeably were to go there. With the return to town, which was accomplished well before eight o'clock, ended the most successful meeting the Institution has held since its inauguration.

REPORT OF PROCEEDINGS.

The General Meeting of the Institution was held last Wednesday and Thursday, at the Institution of Civil Engineers, Great George Street, Westminster.

Mr. JOHN METHVEN, the retiring President, occupied the chair at the commencement of the proceedings.

ANNUAL REPORT AND ACCOUNTS.

The report of the Council (given in the JOURNAL for the 1st inst.) and the statement of accounts were received and adopted, on the motion of the CHAIRMAN.

NEW MEMBERS AND ASSOCIATES.

The Scrutineers reported that the following gentlemen had been admitted into the Institution:—

MEMBERS.

Cash, J., Engineer, Gas-Works, Hove, Brighton.
Guyatt, T. A., Manager, Gas-Works, Ely, Cambs.
Stevenson, F. W., Engineer, Gas-Works, Sheffield.
Townsend, H., Engineer, Gas-Works, Plymouth.
Wood, C., Engineer, Gas-Works, Bradford.

ASSOCIATES.

Colman, H. G., Gas-Works, Saltley, Birmingham.
Ohren, C. M., Gas-Works, Lower Sydenham.

Mr. Methven then vacated the chair, which was taken by Mr. ALFRED COLSON (Leicester), the new President.

THANKS TO THE PAST-PRESIDENT.

Mr. CHARLES HUNT (Birmingham) proposed a vote of thanks to the retiring President for his services during the past year, which had, he said, been of great value in promoting the success of the Institution.

Mr. W. FOULIS (Glasgow) seconded the motion; and it was carried unanimously.

Mr. METHVEN, in responding, expressed his regret that circumstances over which he had no control had prevented him devoting so much time as he felt he ought to have given to the interests of the Institution. It was probably known to most members that his time had been very much absorbed; but he hoped the Institution had not suffered.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I desire to thank you for the great honour you have conferred upon me in electing me as your President for the ensuing year—a distinction, I assure you, I greatly appreciate, though one I should never have sought. Having received this mark of your confidence, I rely upon your indulgence and assistance in carrying out the responsible duties devolving upon the occupant of the presidential chair, and in endeavouring to secure for our fourth session, such a measure of success as should rightly follow upon our past honourable career.

In conforming to the usual custom of preparing an address, it occurred to me that it might prove not uninteresting to you if I embodied therein some particulars as to the working up of residuals, gathered from my own experience in this department of our gas undertaking. I have been led to this conclusion from inquiries which I am frequently called upon to answer with reference to the subject; and, having devoted both time and attention to it, I hope that the results which I have pleasure in laying before you may prove of some service to those who are contemplating similar work, or who are in doubt as to the advisability or otherwise of entering upon it.

Among the questions generally asked are: Do you advise the manufacture of sulphate of ammonia? Should we be wise in distilling our tar? Is not this latter a difficult and complicated process, and one attended with great risk, both personal and financial, as well as with a liability to bring upon one the censure of sanitary authorities? Can you give the cost of working in each case, so as to enable us to decide definitely whether, or to what extent, it would be to our benefit to distil tar and liquor, rather than sell them as crude products? What capital outlay would be required for the erection of buildings, plant, and apparatus for these purposes? Also, can you give details of the quantities, and values of the bye-products to be obtained by distilling? The answers to these questions depend of necessity upon a variety of circumstances; but they are questions that should be considered by all who are desirous of increasing the prosperity of the undertakings of which they have charge.

The manufacture of sulphate of ammonia in gas-works is no longer uncommon; but there are as yet few instances of the manufacture of tar products in connection with our industry. The great difficulty experienced in obtaining reliable information and data as to the cost of dealing with residuals, regarding both manufacture and erection of works, has often been brought before my notice. This arises from the fact that the industry, being generally in the hands of private firms, the owners are naturally reluctant to divulge the secrets of their business. Again, where it is carried on in gas-works, it is almost invariably so intimately associated with the gas manufacture itself, that it is difficult to arrive at anything like an accurate idea of the actual cost of working. Frequently, it will be found that a large proportion of the labour and apparatus, &c., employed—such as engines, boilers, pumps, and tanks, as well as buildings—is common to the two departments, both gas and residual, and that the cost of production given (say) in the manufacture of sulphate, consists of little more than the value of the acid used, together with an allowance supposed to be adequate for labour; while the estimated sum realized for the liquor worked is arrived at by deducting this amount from the sum received for the sulphate sold. Such items as management, repairs and maintenance, depreciation, interest on capital outlay, and capital employed in working the business, to say nothing of the cost of fuel, gas, water, and incidental expenses, are generally ignored. Similar remarks apply in the few cases where tar distillation is carried on in connection with gas-works. The matter is still further complicated should (as sometimes happens) sulphuric acid be manufactured as well; for, in addition to the points already referred to, unless the purifying department of the gas-works be credited with the commercial value of the oxide used, it follows that the residual works have the advantage of the purifying account. It can thus be seen how fallacious and misleading figures relating to this subject may unintentionally be, even when quoted from public and what are supposed to be accurate and reliable statistics, without a full knowledge of all the attendant circumstances.

For some years prior to 1885, the tar and liquor produced at the Leicester gas-works were manipulated in a small works adjoining the old gas-works, under such conditions as those described. Upon these works becoming obsolete and inadequate, it was determined, in the year referred to, to build new residual works adjoining the Aylestone Road gas-works. In the construction of these, the most modern plant has been adopted; and the arrangements are such that not only are the residual works entirely independent of the gas-works, but the tar and sulphate plant and buildings, with one exception, are further independent of each other. This has facilitated the cost of manufacture being kept distinct in each case. The exception referred to is the foreman's office, laboratory, and weigh office. These together form a small block common to the two departments, the cost of which has been equally divided. The works, which abut on the River Soar, cover about 3½ acres of ground. They are provided with convenient railway (not charged to the chemical department) and canal accommodation, and are laid out with a view to the economy of labour. They are capable, with the addition of a second sulphur-recovery chamber, of producing 100 tons of sulphate per week, and distilling 80,000 gallons of tar, and dealing with the bye-products therefrom, in the same time. The sulphate works include Claus's sulphur recovery plant, and ample storeage for both ammoniacal liquor and sulphuric acid, as well as for sulphate. Adequate storeage for tar and bye-products is provided in the tar-works, also apparatus for making carbolic acid and anthracene cake; but no provision has been made for refining, for the reason that any additional income accruing therefrom would hardly justify the increased risk and outlay that would be incurred. The total cost of the buildings in connection with these works was £11,927, and was, as nearly as possible, equally divided between tar and liquor. This amount is somewhat heavy, but was occasioned in a measure by the nature of the ground, which had to be raised some 6 feet—thus making some portions of the foundations 12 feet, and in one case 20 feet, deep. The outlay included too the cost of a considerable widening of the River Soar, and the construction of a canal wharf. The cost of the tar plant was £3459, and of the sulphate plant £4631; making a total for buildings and plant of £20,017.

In designing the works, great regard was paid to the wishes of the Sanitary Committee of the Corporation, who insisted that, if residual works were established at Aylestone (which adjoins Leicester), they must be so designed and conducted that no nuisance should arise therefrom. Among other things, they refused to allow any drainage over 60° Fahr. in temperature, or which contained any trace of sulphuretted hydrogen, to enter the sewers. They also prohibited, and very properly so, any discharge into the river. The restrictions of the Committee necessitated additional outlay for the provision of condensers for cooling the spent liquor from the ammoniacal liquor stills; for condensing, washing, and purifying apparatus used in treating the gases evolved during tar distillation; and for the erection of a hermetically sealed pitch-house. The wishes of the Committee were strictly complied with, and it is gratifying to record with complete success. Not only is the drainage from the works invariably reduced to the temperature of the river before being turned into the sewer, but it is always free from any suspicion of sulphuretted hydrogen. The pellucid river and brooks surrounding the works, with their shoals of fish, testify to the fact that no breach of faith occurs in that direction; while the flowers and vegetables growing luxuriantly in the workmen's gardens immediately around, and which have won prizes at local flower shows, are conclusive evidence that the atmosphere is as uncontaminated as are the river and sewer. Furthermore, the Government inspector has upon no occasion expressed other than entire satisfaction with the method and result of our working from a sanitary point of view. It is but right to say that this has been accomplished only by the aid of the best apparatus and methods of manufacture (not the least important of which is Claus's sulphur-recovery process), as well as by the exercise of the utmost vigilance and thorough and constant supervision, more particularly as regards tar distillation. It will be remembered that, by an amendment to the Alkali Act of 1881, tar works as well as sulphate works are now placed under the control and supervision of the Local Government Board.

Coming now to the financial side of the question. The following analyses of accounts show the result of working both tar and ammoniacal liquor for one year. The figures relating to tar are taken for the year 1892; while those for liquor are for 1893. I have selected the previous year for the tar analysis for the reason that during, and for some time subsequent to, the great coal dispute of last year, our coal was carbonized at such high heats, in order to obtain the maximum quantity of gas, that the resultant tar was for the time being little other than pitch. So thick indeed was it, that frequently a spade would have been more suitable for dealing with it than a pump. Consequently any figures obtained during such an abnormal state of things would be misleading. The conditions during the years selected were normal; and the results obtained are representative of our seven years' experience (with the exception of the period just referred to) at the new works.

Tar Products Manufacture for the Year 1892.

Dr. Tar distilled, 6925 tons. Cr. Tar made, 6610 tons.

		Per Ton of Tar Distilled.				
		s. d.			Gallons.	
To Stock	£4,714 14 5		By Tar		5,578	£93 0 9
Salaries	155 0 0	5·37	Crude naphtha, 30 per ct. at 120° C.		44,424	2,360 13 5
Wages	1,030 16 2	2 11·72	Carbolic acid, crude 60°		5,440	305 10 6
Repairs and maintenance	311 9 2	10·79	Heavy naphtha, 20 per ct. at 160° C.		20,383	406 5 8
	Tons. Cwt.		Creosote		437,152	2,396 6 6
Fuel	1013 3	361 18 2	1 0·54	Ammoniacal liquor		34,625	39 5 0
Caustic soda	28 18	216 12 5	7·50		Tons. Cwt.	
Sulphuric acid	54 1	108 3 0	3·74	Naphthalene	39 17	75 5 5
Casks and bags		202 8 8	7·01	Anthracene, 33 per cent.	43 10	872 10 4
Carriage (tar)		67 0 10	2·32	Pitch	4036 8	4,533 14 7
Ditto (products)		122 13 1	4·25	Sundries		37 13 1
Stationery and printing		11 0 4	0·38	Stock		4,442 3 1
Gas		56 8 0	1·95			
Water		24 17 7	0·86			
Depreciation		345 18 6	11·98			
Interest		438 16 1	1 3·20			
Sundries		91 4 7	3·16			
	£8,259 1 0	10 2·83				
To Balance, being amount realized for the year	7,303 7 4					
	£15,562 8 4					£15,562 8 4
Amount realized per ton of tar made, £1 2 1·17			Amount realized per ton of coal carbonized		1s. 4·03d.	

Sulphate of Ammonia Manufacture for the Year 1893.

Dr. Ammoniacal liquor distilled, 3,700,096 gallons, 10-oz. strength. Cr. Ammoniacal liquor made, 3,588,096 gallons, 10-oz. strength.

		Per Ton of Sulphate Made.				
		£ s. d.			Tons. Cwt.	
To Stock	£4,988 19 7		By Sulphate of ammonia		1,481 14	£17,704 17 0
Salaries	176 5 0	2 5·19	Stock			5,035 0 8
Wages	784 8 1	10 9·92				
Repairs and maintenance	415 10 7	5 8·82				
Fuel	5 16 11	0·96				
	Tons. Cwt.					
Sulphuric acid	1315 2	2,578 6 2	1 15 7·04			
Lime	136 6	129 7 9	1 9·43			
Bags		165 2 9	2 3·35			
Carriage (liquor)		99 8 2	1 4·46			
Ditto (sulphate)		307 14 11	4 2·97			
Stationery and printing		7 7 11	1·22			
Gas		59 4 3	9·80			
Water		29 17 1	4·94			
Depreciation		463 2 4	6 4·70			
Interest		392 2 0	5 4·94			
Loss on sulphur recovery		35 0 5	5·80			
Sundries		63 9 4	10·51			
	£10,701 3 3	3 18 10·11				
To Balance, being amount realized for the year	12,038 14 5					
	£22,739 17 8					£22,739 17 8
Amount realized per ton of liquor made, 10-oz.	14s. 9·15d.		Amount realized per ton of coal carbonized		2s. 3·55d.	

Sulphur Recovery for the Year 1893.

Dr. Cr.

			Tons. Cwt.		
To Stock	£51 10 0	By Sulphur	19 4	£40 2 6
Wages	19 6 10	Stock		47 0 0
Repairs and maintenance	1 13 10	Balance		35 0 5
Carriage	2 0			
	Tons. Cwt.			
Oxide of iron	15 0	22 10 0		
Stone lime	10 6	2 10 8		
Royalty		23 14 1		
Sundries		15 6		
	£122 2 11			£122 2 11

The various items in the foregoing analyses for the most part explain themselves; but a few words of further exposition with regard to some of them may be given. In both branches of manufacture, the apparatus is returned in stock. The items, "salaries," include a clerk's salary, with a proportionate amount for management. The foreman's pay is included in "wages." The works are maintained in a thoroughly efficient state, both as regards apparatus and buildings; a reasonable amount being annually expended upon repairs and maintenance. This item for both tar and liquor, in the years cited, is rather below the seven years' average, which for tar is 1s. 4d., instead of 10·79d. per ton, and for liquor 6s. 2d., instead of 5s. 8·82d. On the other hand, items "wages" are a little above the average. As regards fuel, for tar distilling this consists of coke, which is charged at contract price—that being what it would realize if added to the surplus stock and disposed of elsewhere. For

sulphate manufacture, steam is raised entirely by breeze dust, used under a forced draught; and, as this material had frequently to be disposed of as refuse at some little expense, sulphate is debited with the cost of carriage only, which is seen to be insignificant. Formerly, coke was used for this purpose also, at a cost of 7s. 6d. per ton of sulphate made.

Reverting to the tar analysis, the items for caustic soda and sulphuric acid are both low, inasmuch as carbolic acid was made for a few months of the year only, owing to its reduced market value. These two items would be excluded in arriving at the cost of tar distilling as generally understood, together with, in this instance, £50 from wages. Carriage "tar" and "liquor" is the cost of conveying the residuals from the old gas-works to the new. Carriage "products" will necessarily vary according as the products are sold at port or on rails, Leicester. Depreciation is charged at the rate of 10 per cent. per annum upon the original cost of the apparatus. The items "interest" embrace interest on cost of buildings; on the total value of stock, including apparatus (already depreciated 10 per cent.); and on the working capital—each at the rate of 4 per cent. per annum. Sulphate is debited with a small loss arising from "sulphur recovery," as shown in the last table. This is an unusual charge, and is brought about by underestimating the stock at the end of the year. The result of the seven years' working of this process shows a profit of £28, after paying a total of £118 7s. 1d. for royalty, which payment now ceases. It should be observed that "sulphur recovery" is debited with the expenses incurred in connection with the oxide of iron and carbonate of lime catch-boxes.

It will thus be seen that the chemical department bears its own expenses throughout, and is charged with every item that would fall upon a private firm, with the exception of ground-rent, rates, and taxes. It is dependent in no other way whatever upon the gas department—even the use of the locomotives, and labour in connection therewith, being charged for. The net result of the year's work in tar distilling shows a balance of £7303 7s. 4d., which is equal to £1 2s. 1·17d. per ton of tar made, or 1s. 4·03d. per ton of coal carbonized. The amount is calculated on the tar made, as any tar or liquor at the gas-works at the end of the year, is treated as part of the residual works' stock, and included therein at its fair value. As regards ammoniacal liquor, the year's work shows a balance of £12,038 14s. 5d., equal to 14s. 9·15d. per ton of liquor made, and 2s. 3·55d. per ton of coal carbonized. Although these results will not, I believe, be considered unsatisfactory, I may point out that Leicester, from its inland position, is as disadvantageously placed for this business as perhaps any town in the kingdom. Situated as it is, practically in the centre of England, heavy rates are entailed on all products sent to port or refiners—amounting on sulphate of ammonia to over 11s. per ton, exclusive of dock dues, and on tar products to an average of 6s. per ton of tar. Sulphuric acid also has to be brought from a distance of nearly 100 miles, at a rate of 8s. 4d. per ton.

In order to gather a true estimate of the general working of this department, it will be as well to compare these results with those obtained during each of the seven years the works have been in operation. The following table supplies this information. It will be remembered that during 1887 the tar trade suffered great depression.

Tar.

	Amount Realized.	Tons Made.	Realized per Ton.
1887	£2,842 3 10	5,262	10s. 9·63d.
1888	6,230 1 8	5,696	21 10·50
1889	9,278 7 5	5,856	31 8·26
1890	9,720 14 5	6,130	31 8·58
1891	9,044 9 2	6,337	28 6·53
1892	7,303 7 4	6,610	22 1·17
1893	5,642 1 1	6,355	17 9·07
	£50,061 4 11	42,246	23s. 8·39d.

Ammoniacal Liquor.

	Amount Realized.	Tons Made.	Realized per Ton.
1887	£7,133 16 9	13,159	10s. 10·11d.
1888	7,621 18 4	13,151	11 7·09
1889	7,883 4 3	14,216	11 1·08
1890	7,775 7 6	15,402	10 1·15
1891	7,319 0 9	15,895	9 2·51
1892	7,111 14 1	16,299	8 8·71
1893	12,038 14 5	16,309	14 9·15
	£56,883 16 1	104,431	10s. 10·72d.

In this table will be seen the reduced amount realized per ton of tar for the year 1893. For the first half of the year, when the tar distilled was of the usual quality, the amount realized per ton was £1 1s. 5·44d.; but for the second half, and for the reasons already stated, the return was only 14s. 2·33d.—making an average for the year of 17s. 9·07d. Had no alteration been made in the quality of the tar, the financial result of the year's working would have equalled at least that of 1892. I may say, however, that what was lost in the tar was compensated for by the increased yield of gas.

The following are the particulars of bye-products from each ton of tar distilled, for the year under review, 1892:—

Crude naphtha, 30 p. c., at 120° C.	6·79 gallons.
Carbolic acid, crude 60°	1·14 "
Heavy naphtha, 20 p. c., at 160° C.	3·55 "
Creosote	58·04 "
Ammoniacal liquor, 10 oz.	5·00 "
Naphthalene	33·91 lbs.
Anthracene, 33 per cent.	13·60 "
Pitch	12·67 cwts.

As already mentioned, carbolic acid (owing to its low market value) was made for a short time only. The yield of this from our tar, averages 3½ gallons per ton; the cost of making being about 10d. per gallon. The foregoing results were obtained from tar made from coal carbonized at what may be termed fairly high heats, and which yielded 10,436 cubic feet of 17-candle gas per ton. The coals used consisted of 73 per cent. of best Derbyshire; 18 per cent. of South Yorkshire; and 9 per cent. of Nottinghamshire cannel. From these were obtained 12·1 gallons of tar, and 32·8 gallons of ammoniacal liquor of 10-oz. strength, per ton. The quantity of sulphate made per ton of coal equivalent to liquor used, was last year, 29·82 lbs.; this having been our maximum yield.

It may be mentioned that the manufacture of sulphate and bye-products is not continued throughout the year—both tar and liquor are stored during at least five months. Operations usually commence at the beginning of October, and continue till the end of March or the beginning of April. They are again resumed for the last three weeks in June, in order to exhaust the stocks for the half year, from which time the manufacture remains in abeyance till October. It is found that this method of working is attended with considerable advantage. It greatly lessens the cost of manufacture, inasmuch as it allows the apparatus being worked at its maximum while in operation, and, what is of much importance, it avoids all chance of odours emanating from the works during the hot weather, and prevents loss of the more volatile products, such as naphthas, by evaporation. It has the advantage also of allowing the apparatus to be overhauled, cleaned, and repaired while out of action.

The members of this Institution may be interested in hearing that eight-hour shifts have been in vogue among the majority of the men at these works for the past three years. Previously, the still-men—both tar and liquor—were engaged upon twelve-hour shifts; and as the nature of their work does not admit of regular meal times, they were paid for the twelve hours full at 5½d. per hour, or 5s. 6d. the shift. In consequence of the health of the men being below the average, it was determined to try the experiment of eight-hour shifts, at 4s. 6d. per shift, in the place of the twelve. At the time, the men were far from approving of the change; and they submitted to it with reluctance, no doubt on account of the reduced pay. I am glad to say, however, that the change has proved in every way beneficial. The men are contented, and would be sorry to return to the former system; they are physically more capable of performing their duties, and the general health is much improved; while it cannot be said that the item of wages has been appreciably increased. The system admits also of a greater number of men being employed at what are still good wages. My experience in this matter has led me to conclude that this method might with advantage be adopted in all works of a similar character, and working under like conditions. The few odd men about the works make the ordinary time—namely, 9 hours per day.

We come now to the question of paramount importance—viz., What monetary advantage can be claimed by the results as set forth? It has been my practice to carefully note the prices realized from time to time for tar sold under contract; and seeing that in Leicester we are at so great a distance from tar distilleries of any magnitude,

and should consequently have to suffer heavy loss by carriage, I estimate we should not have obtained for the year 1892 more than 12s. 6d. per ton for the raw material, as against 22s. by distilling. Then as regards ammoniacal liquor. For this 7s. 6d. per ton is the utmost we should have realized for the year 1893, again by reason of transit, which thus leaves about 7s. 6d. per ton as net gain by working. To put it briefly, the figures show that Leicester increases her municipal income to the extent of from £8000 to £10,000 per annum by the residual works in connection with the Gas Department—an amount representing at least 2d. per 1000 cubic feet of gas. In addition to this annual income, the entire plant and apparatus will, in less than three years' time, be paid for. The town will then possess works which, as far as apparatus is concerned, will be free from debt, and, if maintained as hitherto, in good condition.

Reverting to the questions enumerated at the opening of my address, I should say without any hesitation, unless there were some insurmountable difficulty, as regards situation or drainage, or an exceptionally favourable contract could be made under a sliding scale, that, generally speaking, it would be an advantage for gas undertakings to manufacture sulphate of ammonia. It is a process that can be carried on, if proper plant and apparatus be employed, and due precautions taken, without any risk of creating a nuisance, or being in any way detrimental to health.

As regards tar distillation, this is a much more complicated subject, and one that should not be decided upon without due thought. Where the circumstances are similar to those which obtained in Leicester—that is, heavy carriage and little or no competition for the tar, a suitable site adjacent to the gas-works, with good drainage, and an unlimited water supply available, there can be but one answer—viz., distil. But as these conditions do not always exist, each case must be decided upon its merits. As to carriage, this is not of such moment in the case of tar as in that of ammoniacal liquor; for while tar yields nearly its own weight in products, about 11 tons of liquor are needed to make one ton of sulphate. It cannot be denied that tar distilling is a speculative and fluctuating business, and one requiring constant and persistent supervision. Although, fortunately, we have had no accident in our residual works at Leicester, the processes involved in tar distillation are always attended with some degree of risk, both as regards life and property; and the work generally is a source of anxiety. The risk to property is evidenced by the difficulty in getting tar-works insured. In our case, this could only be done to the extent of £5000 by two pclicies of £2500 each, for which we have to pay a premium of 8s. per cent. per annum (included in sundries). My advice, therefore, is that if a fair price can be obtained by selling the tar, avoid the trouble and anxiety inseparable from distilling, by disposing of it. If this can be done under a sliding scale based upon the value of the chief crude products, such a method is preferable; but here great caution is necessary, owing to the difficulty at times of agreeing upon the value of the bye-products. Yet my experience is that this is a matter which can be satisfactorily arranged if the arbiters, while fully alive to the interests of their clients, approach the subject in a fair and equitable spirit.

Although I have referred to the drawback of having apparatus and labour common to both gas manufacture and the working-up of residuals, let it not be understood that I consider such a combination undesirable in every instance. On the contrary, in works of medium size, an arrangement of this kind would, I believe, in the majority of cases, prove of great advantage, both for sulphate manufacture and tar distillation. But in works of any magnitude, I would certainly advise a separate and independent residuals department. In small works, while it might be advantageous to manufacture sulphate, I do not think that under any conditions it would be advisable to distil tar. Whether there could be a combination of small gas-works, with the object of securing the advantages of tar distillation conjointly, as has been more than once suggested, is in my judgment very questionable. But again the answer to this question would depend upon circumstances.

Having demonstrated the extent to which, under certain conditions, the finances of a gas undertaking may be augmented, by having in connection therewith so interesting a branch of the industry as a chemical works, I should like to refer to a comparison I have lately made, showing the relative influence upon the consumption of gas (and therefore upon the finances of our gas undertakings in another direction) by the use of engines and cooking-stoves. Estimates have from time to time been made of the quantity of gas used by cooking-stoves; but I know of none, with regard to that taken by the total number of engines in use in any large town. A favourable opportunity has been afforded me for arriving at this, inasmuch as we let on hire wet meters only, which has necessitated the purchase by the consumers, of the dry meters required in connection with the engines. The result is that, with scarcely an exception, we have in our books a separate registration of the gas used by every engine in the town. The table herewith inserted, for the year 1893, gives the various sizes of engines in use, the number of each size, together with the total horse power, also the average and total consumption of gas per engine, and, in addition, the number of engines employed in different trades, and the quarterly and year's consumption of gas by each trade. For the engines fixed during the year, the full twelve months' consumption has been calculated from the actual quantity of gas consumed by each for the time being.

Gas-Engines in Leicester, 1893.

Gas-Engines.				Total Consumption of Gas for the Year. Cubic Feet.	Average Consumption of Gas per Engine for the Year. Cubic Feet.	Trades or Purposes for which Engines are Used.	Number of Engines Used by Different Trades or Purposes.	Total Nominal H.P. Used by Different Trades or Purposes.	Consumption of Gas by Various Trades by Engines for the Year 1893.				
Size. Nom. H.P.	Number at Work.	Total Nom. H.P.	Total Ind. H.P.						Lady-day Quarter, Cubic Feet.	Midsummer Quarter, Cubic Feet.	Michaelmas Quarter, Cubic Feet.	Christmas Quarter, Cubic Feet.	Total Cubic Feet.
1 Man	2	2½	5	117,500	58,750	Boot & shoe manufacture . .	122	644¾	8,714,500	8,798,300	8,487,300	8,916,100	34,916,200
5 ,,	2			46,100	23,050	Hosiery manufacture . . .	56	207½	3,440,200	3,456,800	3,662,100	3,602,700	14,161,800
6 ,,	1			127,400	127,400	Electric lighting	10	73½	819,600	705,500	692,100	892,900	3,110,100
½ h.p.	8	2	40	651,900	81,487	Coffee grinding	2	5½	124,800	89,200	83,000	127,200	424,200
¾ ,,	38	19	95	2,102,400	55,326	Sand paper manufacture . .	1	½	13,000	13,500	14,400	14,400	55,300
¾ ,,	2	1½	6	196,100	98,050	Cigar manufacture	1	¾	23,600	7,000	15,300	42,600	88,500
1 ,,	35	35	115	2,707,600	77,360	Needle making	1	½	10,600	8,200	8,100	10,000	36,900
1½ ,,	4	6	15	316,400	79,100	Engineers & machinists . .	45	126½	1,773,300	1,662,200	1,632,200	1,844,100	6,911,800
2 ,,	57	114	256	6,399,100	112,264	Printers	33	115½	1,271,500	1,197,200	1,210,600	1,310,900	4,990,200
2½ ,,	11	27½	60	1,575,500	143,227	Corn merchants.	16	71½	525,200	337,300	437,600	610,100	1,910,200
3 ,,	22	66	143	2,835,200	128,872	Mineral water manufacture .	13	26½	199,200	294,700	318,000	209,100	1,021,000
3½ ,,	26	91	211	3,316,000	127,538	Builders & timber merchants.	21	127	1,084,000	1,057,200	1,003,800	1,089,100	4,234,100
4 ,,	28	112	274	5,347,900	190,996	Bakers & confectioners . .	11	26	286,900	246,400	254,100	364,800	1,152,200
4½ ,,	2	9	21	253,900	126,950	Brewers & maltsters . . .	10	22½	232,100	148,300	106,400	255,600	742,400
5 ,,	8	40	91	1,463,800	182,975	Elastic web & braid manufact.	8	62½	1,159,900	1,134,200	1,117,700	1,041,000	4,452,800
6 ,,	53	318	689	14,029,200	264,701	Wool spinning	5	12½	73,100	61,600	66,200	65,500	266,400
7 ,,	21	147	327	7,184,100	342,100	Fancy box manufacture . .	3	14	178,900	178,500	175,700	170,600	703,700
8 ,,	16	128	280	5,818,500	363,656	Cabinet & pict. frame making	6	17½	227,400	159,900	154,500	217,500	759,300
9 ,,	12	108	234	6,129,100	510,758	Rope manufacture	3	14	141,800	123,800	115,500	139,900	521,000
10 ,,	5	50	107	2,306,700	461,340	Wholesale clothiers . . .	2	15	213,700	207,000	229,900	181,800	832,400
12 ,,	15	180	393	11,179,500	745,300	Dairies	2	½	40,200	17,600	15,100	38,400	111,300
14 ,,	4	56	132	2,780,800	695,200	Pumping & ventilating. . .	4	16	292,200	178,400	186,900	195,700	853,200
16 ,,	2	32	82	1,457,000	728,500	Manufacturing chemists . .	2	4½	42,700	42,700	39,700	38,000	163,100
20 ,,	3	60	147	4,076,400	1,358,800								
	377	1604½	3723	82,418,100			377	1604½	20,888,400	20,125,500	20,026,200	21,378,000	82,418,100

The table includes particulars referring to 377 engines, varying in size from 1-man power to 20-horse power nominal, which engines are working most satisfactorily. I t shows that the year's consumption per engine ranged from 23,050 to 1,358,800 cubic feet, and that their total consumption amounted to 82,418,100 cubic feet. In addition to the engines enumerated in the table, there are 36 others, equalling 253-horse power nominal, which have been fixed during the present year, including five of 20-horse power each. The consumption of gas by these will amount to at least 10,000,000 cubic feet per annum; making a total annual consumption of 92,000,000 cubic feet, the greater proportion of which will be used during daylight hours. This quantity amounts to 8·52 per cent. of last year's consumption for all purposes. I find that the engines at present are working at scarcely half their limit; for supposing them to work for 54 hours per week, as they nearly all do, and allowing 20 cubic feet of gas per indicated horse power per hour, the consumption of gas would be over 200,000,000 cubic feet per annum. Here then is a source of increasing consumption without considering any prospective increase in the number of engines. It is quite evident from these figures that no pains should be spared on our part to secure the success of every gas-engine put down, by seeing that mains and services are sufficiently large, and the pressure ample for ensuring at all times an adequate supply of gas. I attribute in a measure the success of the gas-engine in Leicester, where its use is rapidly extending, to the careful attention that is paid to these requirements. As to the day pressure under which gas is supplied, my practice does not accord with the advice given in the well-known "golden rule" relating thereto. Until ten years ago, the rule referred to was carefully observed, with the object of keeping the "unaccounted-for" at a minimum; but so much trouble and annoyance were experienced with regard to the supply to both engines and cooking-stoves during the daytime, that the pressure was gradually increased from 10-10ths to 19-10ths, and with the best results. It may surprise some to learn that this increase of pressure has led to no increase in the "unaccounted-for," the average of which for the last ten years, under the higher pressure, is 2·67 per cent.; while for the previous six years, under the lower pressure, it was 3·16 per cent. It is needless to say that the distributing plant is in first-class condition.

We will now see how the consumption of gas is influenced by the use of cooking-stoves. It is fourteen years since the hiring-out system was introduced into Leicester; and, during that time, no effort has been spared to bring the advantages of cooking by gas before the public, with the result that we have at the present time 5860 stoves in use. I have been at some pains to ascertain the influence these have upon the consumption. In order to arrive at this, an average meter system has been adopted; a number of meters being attached to the various sized stoves in use in average families. The meter states were taken monthly for several years; and the total consumption calculated therefrom. From time to time, the meters were changed to other stoves of the same sizes, with a view to obtaining greater accuracy. Without troubling you with a mass of figures, suffice it to say that I estimate the quantity of gas consumed by the total number of stoves to be 120,000,000 cubic feet for one year, or 10 per cent. of the present total consumption. At least 80 per cent. of this would be used during daylight hours; and the consumption during the summer months would be perhaps 50 per cent. in excess of that of the winter. When previously I went into this matter, I estimated that for the year 1885 the gas used by the stoves then fixed amounted to 35,000,000 cubic feet; so that in nine years the consumption of gas from this source has more than trebled.

What strikes one so forcibly on comparing the results obtained, in the way of consumption of gas, in these two directions—*i.e.*, by engines and cooking-stoves—is the difference in the outlay, labour, and responsibility incurred in the one case as compared with the other. As regards the gas-engines, which at present increase our consumption by 8½ per cent., all that is required is the laying of a proper service, and the work, so far as we are concerned, is practically done; we have no further responsibility other than that of maintaining an efficient supply of gas. The letting of stoves, on the other hand, which represents 10 per cent. of the total consumption, presents a remarkable contrast. This in itself has created an additional department in the undertaking, entailing all the minutiæ of a retail business. It necessitates, as you know, a considerable first outlay, and office and showroom accommodation, as well as workshops, together with an organized staff for working the department; while the charges appearing at the end of the year for interest, depreciation, and repairs and maintenance, are by no means insignificant. True, rents are charged which cover some of these items; and the general result proves that the extension of the use of cooking-stoves should be the zealous aim of gas producers. But in manufacturing towns, where there must be a wide field for them, should not increased efforts be made to extend the use of gas-engines, and would not these eventually prove to be of even greater benefit to the gas industry in such places than cooking-stoves? While saying this, I am not overlooking the fact that the gas-engine, although largely instrumental in increasing the day consumption, is of less service than the cooking-stove in equalizing the winter and summer consumption, as may be seen upon referring to the table before mentioned. As we are aware, the stove makers have had our enthusiastic assistance; while little help has been rendered by us in extending the use of the gas-engine. Surely this is hardly as it should be, especially when our interests appear to dictate a more energetic policy in their behalf. I would not suggest that gas-engines should be let on hire, nor would I advocate gas for engines being supplied at a lower rate than is charged to the ordinary consumer; but evidently we might, with considerable advantage, assist in bringing the merits of the gas-engine more prominently before the public than has yet been done. The advantages to be obtained by their use are such that there must be a great future for gas as a motive power. A glance at the table shows how various are the trades and purposes to which the engines are at present applied; and what possibilities do not these suggest for further extension and usefulness?

Bearing upon this subject, I should like here to refer to a special effort that was recently made in connection with the undertaking with which I am associated to further popularize the use of cooking-stoves and other gas-consuming apparatus, including engines. These efforts took the usual form of an exhibition. For this purpose, the largest hall in the town was hired, and made as attractive as possible by means of bunting, shrubs, flowers, and fountains, while a good band belonging to the Gas Department was in attendance each afternoon and evening. The exhibitors were supplied with space and gas free of charge. It had previously been the practice to confine the orders for stoves to a limited number of approved firms. This no doubt in the early days, when there were but few good makers, was a wise precaution; but since there are now many competent manufacturers of stoves, such a practice is invidious, and not conducive to improvement. For these reasons, free trade was determined on, and the exhibition thrown open to any makers to exhibit and let on hire as they were able, but without any guarantee that we should continue to purchase their stoves after the close of the exhibition. The exhibition was formally opened with municipal honours, on the 10th of July last, and continued for seventeen days. A small charge was made for admission during the first week; afterwards the evening of each day was free. Cookery lectures and demonstrations were given twice daily, and were attended by 4250 people; the lecture room being crowded each time with deeply interested and, in fact, enthusiastic audiences. The total number of visitors to the exhibition amounted to 49,214; and the number of stoves hired during the time was 1671, at rents ranging from 2d. to 5s. per quarter. Of this number, however, some scores were changes from small to larger sizes. A quantity of other apparatus, including several gas-engines, was also disposed of. It is evident from these results that, although gas exhibitions have long since ceased to be a novelty, their day of usefulness is by no means over. Their influence too continues long after they are closed. Without doubt it would be of great benefit to hold one every four or five years, till practically every consumer of gas has a stove hired or purchased. I think it is possible for this in time to be achieved.

It is a pleasure, before dismissing this subject, to refer to the third section of the report of the *Lancet* Special Analytical Sanitary Commission issued in November last.

It will be remembered that the object of the Commission was the study of appliances for the prevention of smoke; and it must be admitted that, in spite of some imperfections, no more comprehensive investigation of the subject has ever been published, and that it reflects the highest credit upon those engaged in it. It is certainly a matter for congratulation that the testimony of the leading medical journal is so emphatically in commendation of gas as a fuel for domestic purposes, and that no higher praise has ever been bestowed upon either gas heating or cooking stoves than that contained in the report of its Special Commission. It is a report that should be studied by every gas engineer and manager in the country; for its contents, if disseminated, cannot do other than still further extend the use of gaseous fuel. It is gratifying to know that there is a prospect that the scope of the inquiry may be extended at some future time; but, before this is done, I would suggest that if the *Lancet* were first to consult with the Council of this Institution, it could obtain hints that would be of assistance in any further investigation into the value and merits of the different kinds of gas appliances.

When commencing this address, it was my intention to touch upon the subject of electric lighting; but I find I have already reached the limit I set myself. Before closing, however, it is only natural that the occupant of this chair should be expected to make some reference to the event of the past year. But what is there that has not already been said concerning the great coal strike, or rather, as we were advised by a very high authority, the "lock out?" We all deplored it, many of us suffered keenly by it, and sincerely hope that we may be spared such another experience as that through which we passed in the decline of the year 1893. It has been alleged that our industry, involving as it does such large purchases of coal, was in a great measure responsible for the trouble; but this I cannot concede. It is true that nearly 12 million tons of coal are required for gas manufacture this year; but large as this quantity is, it is but small when compared with the total demand for all purposes, amounting to about 180 million tons. Our influence, therefore, upon the coal market is by no means so great as is often represented. We have, of course, to safeguard the interests committed to us; but there is not one of us who would prevent the miner from obtaining a good and well-deserved wage, neither would we hinder the colliery proprietor from securing a fair investment for his capital. Those now engaged in endeavouring to reconcile these conflicting interests have our utmost sympathy, and deserve every assistance. For the sake of those directly concerned, as well as for the common good, it is to be hoped that on all sides there will be evinced a spirit of conciliation—of "Live and let live." As an outcome of the dispute, that we shall in future hold larger stocks of coal, goes without saying. In many cases this no doubt will be inconvenient, and will add somewhat to the cost of manufacture; but these drawbacks will be considerably less than if the open market should have to be resorted to in an emergency.

Another result will probably be a general overhauling of agreements before the next coal contracts are made. By some of these, colliery proprietors are freed from responsibility in cases of strikes and accidents only; while in others their responsibility is allowed also to cease during lock-outs. Where the latter are provided against, I am quite unable to see the justice of any such agreement. Surely a deed of contract is intended for the mutual protection of the contracting parties; but what protection has a gas company or corporation under an agreement which enables a colliery proprietor, having made an unfortunate contract, to release himself from his obligations by simply deciding upon a lock-out? Any such agreement as this places the buyer absolutely at the mercy of the seller. This is a matter that should receive the careful consideration of those responsible for the negotiation of contracts.

In preparing this address, I have confined myself mainly, to some of those subjects to which circumstances have called me to give special attention, deeming this course in some respects preferable to dealing with gas engineering generally, which has been so often and ably treated. I thank you, gentlemen, for your kind attention.

Mr. George Livesey moved a cordial vote of thanks to the President for his address, which was, he said, as practical and useful a one as he had ever heard. It showed the work the President had done; and it would, he was sure, be appreciated by every member.

Mr. G. C. Trewby seconded the motion, which was carried unanimously, and briefly acknowledged.

Reading of Papers.

The reading of papers was then commenced. They were taken in the following order:—

Wednesday.—(1) "The Relations of Capital and Labour in Gas-Works." By G. Livesey. (2) "Gas-Works Extensions in Stockport." By S. Meunier. (3) "Motors for Lighting or Generator Gas *v.* Engines with Saturated or Superheated Steam." By Bryan Donkin.

Thursday.—(4) "A Comparison: Stoking Machinery or Inclined Retorts." By F. Livesey. (5) "Foulis-Arrol Stoking Machinery at East Greenwich." By J. Tysoe. (6) "Enrichment of Coal Gas." By J. Ferguson Bell. (7) "Notes on the Enrichment of Coal Gas, more particularly bearing upon Enrichment by the Peebles Oil-Gas Process." By S. Glover. (8) "The Introduction, Development, and Practical Working of the Oxy-Oil Gas Process at the Huddersfield Gas-Works." By W. R. Herring. The remaining paper on the list—viz., "The Relation of Carburetted Water Gas to the European Gas Industry in 1894," by Mr. A. M. Paddon—was, for want of time, taken as read.

The first two of these papers, with a report of the discussion on Mr. George Livesey's, are given in another part of the Journal; the remainder, with the discussions thereon, being held over for subsequent issues.

At the close of the discussions on Thursday afternoon, the general business was resumed.

Appointment of Scrutineers.

Mr. R. O. Paterson (Cheltenham) moved the re-election of Messrs. Lacey, M'Minn, and Tysoe as Scrutineers for the ensuing year; and the motion was carried.

Votes of Thanks.

The President moved a vote of thanks to the authors of papers.

Mr. Methven seconded the motion; and it was passed.

The President next moved a hearty vote of thanks to the President and Council of the Institution of Civil Engineers, for kindly allowing the use of their hall for the purposes of the meeting, entirely free of charge.

Mr. T. May (Richmond) seconded the motion; and it was carried unanimously.

The President then proposed that the best thanks of the Institution should be given to Mr. Magnus Ohren, the Honorary Auditor. In doing so, he expressed the gratification of the Council at the fact that, though Mr. Ohren had retired from the auditorship, he still remained a member of the Institution.

Mr. W. R. Herring (Huddersfield) seconded the motion, which was carried unanimously.

Mr. Corbet Woodall moved a vote of thanks to the Council for their services during the past year. He said it had been his misfortune not to be able to be present during a large portion of the meeting; but, owing to the admirable arrangement of the Council in printing the papers in advance, those who were prevented from attending were able to see something of the work which was going on. The *pabulum* provided for the meeting was the best testimonial which could be given of the devotion of the Council to the service of the Institution.

Mr. T. Holgate (Halifax) seconded the motion; and it was carried unanimously.

Mr. Methven, on behalf of the Council, expressed their thanks for the members' kind appreciation of their work.

The President said the last resolution he had to propose was that the best thanks of the members be presented to the Secretary; and he had great pleasure in bearing testimony to the excellent manner in which Mr. Cole had discharged his duties. The success of the meeting had been largely due to the energetic manner in which he had carried out everything devolving on him.

The motion was seconded by Mr. Lacey, and carried unanimously.

The Secretary, in acknowledging the vote, said there was evidence on every side of the success of the Institution; and he could assure the members that, so long as he

was Secretary, he should have great pleasure in doing all he could to promote its interests.

Mr. W. Foulis then proposed a hearty vote of thanks to the President, for the very able manner in which he had conducted the business of the meeting.

Mr. Charles Hunt seconded the motion; saying that Mr. Colson's conduct in the chair justified them in expecting a most prosperous year under his guidance. He felt sure the Institution would gain considerably in strength during his year of office.

The motion having been carried by acclamation,

The President, in responding, said he was very gratified if he had been able to do anything for the success of the meeting; and he looked forward with pleasure to seeing the members at Leicester in the autumn.

The proceedings then closed.

PAPERS AND DISCUSSIONS.

THE RELATIONS OF CAPITAL AND LABOUR IN GAS-WORKS.

By George Livesey.

Twenty years or more ago, the writer made the rather thoughtless remark to a director, to which he assented, that a gas company was simply a dividend-making machine. Although it is quite true that but for the prospect of dividends there would neither be gas nor any other companies, gas undertakings exist for something more than making money. They supply a public necessity, and form an essential part of our complicated civilization; and they have been called upon, in Manchester, Salford, Darwen, London, and elsewhere within the last few years, at great cost in effort and in money, to stem the tide of a great movement of tyranny and oppression that bade fair to destroy throughout the country the liberty of employers and employed. This taught the public and the proprietors and managers of gas undertakings that, in a time of great emergency, it might become their duty, disregarding all pecuniary considerations, to stand in the breach in defence of freedom, to the advantage, as it turned out, of themselves, their workmen, and the entire community.

The relations of capital and labour in gas-works, among other industries, are not, therefore, to be regarded entirely from the very narrow view of so many halfpence per 1000 cubic feet saved or expended, but as part of the great problem of reconciling and identifying those apparently conflicting interests, which is the pressing—nay, the overwhelming—industrial question of the day. Gas undertakings, and especially the companies, having much greater freedom of action than the committees of corporations owning gas-works, occupy a very exceptional position; being practically sure of their profit under all circumstances. They are therefore in a position to do a work which, if faced in a liberal spirit, will not only tend greatly to their own and their servants' advantage, but will materially assist in dispersing the gloom that encompasses the industrial outlook.

For a long time the relations of capital and labour have been slowly, but surely, changing; and they have now reached a point which amounts to a revolution from the time when there existed an intimate relation between the employer and his workman, such as was the case when industry was in a small way, and when the workman, after serving as apprentice and journeyman, might look forward to becoming in turn a master. This is all altered. The growth and development of large industrial establishments has necessarily resulted in separating the workmen, in their lives and pursuits, from those under whom they work. This separation has grown, in many instances, to active antagonism; and it must, unless means can be adopted to prevent it, become more pronounced.

Until quite recently, however, in gas-works the relations were satisfactory. The manager, in many cases residing on or near the works, was in close touch with his men, and knew them personally. Then, as the business increased, especially in the larger concerns, this knowledge of, and intercourse with, the workmen on the part of the manager was impossible; and the men became ready to take up a position of strong antagonism. The opportunity came with the advent of the Gas Workers' Union, which, beginning at Beckton, spread rapidly over London, and thence to the entire United Kingdom. It cannot be said that there was any general ground for such an outburst of discontent and insubordination, which was very similar to that of the dockers, compared with whom the lot of the gas workmen was favourable indeed. If fair treatment and good wages were sufficient to produce good feeling, gas undertakings ought to be in a very happy condition.

In a report on the rates of wages by Dr. Giffen, issued by the Board of Trade in 1892, giving particulars of the average wages in the principal unskilled trades in 1886, it appears that gas workers head the list; and as they have had since that date their full share of the advances that have been made in recent years, there is little doubt that they still occupy the first position as to wages. Good wages and fair treatment, however, have failed to identify the interests of employers and employed. Evidently, therefore, something more—or rather, perhaps, something different—is wanted.

The separation of the workmen, in their lives and pursuits, from those under whom they work, is alone hardly sufficient to account for the existing relations. If it were possible to restore the old conditions, the old relations most certainly would not return. Something more than mere friendly intercourse is wanted. We must therefore look farther for the *substantial* cause of the difficulty; and, without desiring to dogmatize, it may fairly be assumed that it is to be found in the fact that workmen generally have the impression that they are not receiving the value due to their labour. With the increase of education, they have learnt to read, but they have not yet acquired the capacity to form a right judgment of the truth or the soundness of the opinions set before them; and when they are told, as they have been continuously of late, that all wealth is the product of labour, and that they, the so-called producers, are entitled to the whole, they are misled by the sophistry, and the result is a feeling of discontent, which no mere advance of wages can allay, so long as they believe the Socialist doctrine that "Property is Robbery," and that all the means and instruments of production ought to belong to the workers, who, they say, created them. This explains the fact that, after the demands of the Gas Workers' Union had been conceded in 1889, and many of the men individually expressed their satisfaction—saying they had got more, and got it easier, than they expected—this good feeling did not last long, but was followed up by the Union with further demands, to which, if they had not forced a fight and lost, there would have been no end until they had obtained absolute control of the business and ruined it.

To counteract this false and mischievous teaching, it is necessary to show that all wealth is not the product of the labour of the so-called workers, but, as has been so well shown by Mr. W. H. Mallock, in his book, "Labour and the Popular Welfare," recently published by Messrs. A. and C. Black, is mainly the product of what he calls "ability"—that is, the mental and moral power that directs labour, invents means for its employment, and makes it profitable. He sums up his able and interesting argument by stating (p. 164) that "of our present national income of £1,300,000,000 labour produces about £500,000,000, while ability and capital produce about £800,000,000." He says: "It could, indeed, be shown, as I just now indicated, that labour produces less than this, and ability and capital more; but, for argument's sake, we will let the calculation stand thus, in order that labour shall be at all events credited with not less than its due."

The first thing, therefore, is to counteract the false teaching of the Socialists, by showing the working population that they are only entitled to a share of the joint product of capital, labour, and ability, which is not a difficult task when you can get their ear. The next point is to ascertain, as nearly as possible, what is their fair share, and the adoption of means to secure it to them; and not only this, but to convince them that they are fairly dealt with. Thirdly, to turn the flank of Socialism, by giving the workers the opportunity of, and providing facilities for, their becoming property-owners themselves. When once the Socialist nonsense is exposed and refuted, the remainder of the task is easy. Experience has shown that workmen are quite willing to listen to reason, and that they will repay fair dealing with confidence. Where there is an evident desire on the part of an employer to do what he can to meet them, they will generally meet him half way.

The past and present relations between employers and

employed in gas-works have been briefly referred to. But what of the possible future? Is it to be peace, good-will, and contentment, or the reverse? In many places, much of the old friendly feeling remains; in some, where it had been lost, it has been restored, and placed on a better foundation; but in others it is gone. The question then is how to place the respective parties on a mutually satisfactory footing. The first-named will probably allow themselves to drift, on the principle of letting well alone, until they find themselves in the position of the last, instead of taking advantage of a lull in the storm to make themselves safe; while the latter, feeling the stress of their position, may be expected to take measures for its improvement. One course that is becoming general is the adoption of labour-saving machinery, and systems of making gas that require the minimum of labour. These are good, so far as they go; but, beyond making the labourer less independent, they do nothing to improve the relations, or to make them more pleasant, because they fail entirely to produce anything approaching identity of interest.

Another and better plan is the showing of practical sympathy and consideration for the workmen, by encouraging and assisting them to make provision for sickness, accident, and old age, by means of funds established for these purposes, to which both parties contribute, and which are managed by joint committees. Provision should be made for all accidents, and not for the mere 5 or 10 per cent. that can be met by the Employers' Liability Act. That workmen value such funds, there is no room for doubt; and they do much to bring the parties together, though they are not liked by certain trades' unionist officials, who say, in effect, "We wish the workmen to be quite independent of their employers, and to depend upon their societies for everything." This came out very clearly in the discussions on the Employers' Liability Bill; the official unionists saying that, where mutual funds exist, there Trades Unionism is at a great disadvantage. It therefore comes to this: Is it better for the country, and for both or either party, that masters and men should be on friendly terms, or that there should be nothing but wages on one side and work on the other between them?

And now I can follow the rule of the Institution to speak in the third person no longer. In my early life, I had experience for many years of the old times, when I knew every man personally and by name, when the relations were friendly, and work went on satisfactorily, and the men were happy and contented. I have had about six months' highly concentrated experience of the essence of the trade union *régime*, when I knew very few of the men personally, when work was done most unsatisfactorily, and the men—though the concessions made to them were more than they expected, and were most readily granted—were miserable and discontented, and no friendly intercourse was possible. I have also had nearly five years' experience of a kind quite different from either, when, without the old personal acquaintance, more than the old friendliness is restored, coupled with a spirit of confidence in their employers on the part of the men such as I never expected to see. They also, as a rule, seem thoroughly happy and contented with their employment, with the inevitable result that the work is done in a very satisfactory manner, which is attributable to the fact that, under the new *régime*, the men feel they have an interest in the Company, which was totally wanting previously.

It has already been stated that good wages, fair treatment, and friendly personal acquaintance are not sufficient to bind men to their employers now-a-days; neither will liberal concessions to their demands effect that object. In fact, the experience of 1889 showed that it only acted as an incentive to further demands, and certainly did not produce contentment and good-will. At the best it was only an armed peace. To obtain peace with good-will, contentment, and good working, the great *desideratum* is identity of interest, or the principle of partnership. It is no use mincing matters. I am convinced that the future prosperity of industrial life, and proper relations between capital and labour, lie in this direction; and it is the duty, and happily to the interest and advantage also, of employers, to take as their guiding star a real and effective partnership with their workers. The process must necessarily be slow and gradual. The workers have been so long in the position of children, that they have had practically no experience in commercial life, or in the management of the various industries by which they live—in fact, they know nothing on these points. They are, however, willing to learn, if employers will give them the opportunity, to which the first step is a sharing of profits, as it at once creates an identity of interest, and promotes mutual confidence, without which nothing can be done.

At the meeting of the Institution in 1892, a paper on profit-sharing was read, and therefore it is not necessary to deal with the subject at any length; but the developments that have taken place since that time may be mentioned with advantage. The general principle is an annual bonus or percentage on salaries and wages, dependent upon the amount of profits, which in the case of gas undertakings very appropriately follows the lines of the sliding-scale; thus giving the employed an interest in reducing the price of gas. Beyond this, it also has the satisfactory effect of attaching them to their employers, and encouraging thrift. Further, as the condition of acceptance on the part of the employed is the signing of an agreement for a period not exceeding twelve months, and as these agreements expire at different times, a strike cannot take place except by the men breaking their agreements, and thus coming under the severe provisions of the Conspiracy and Protection of Property Act. There is not the slightest objection to the men belonging to a trade union. But gas-works employees are engaged in a work that is a public necessity; and the public safety is endangered by any cessation thereof. It is therefore a fair, and ought to be an absolute, condition that men who accept such employment should forego the power of striking. This, happily, they are quite willing, and, if the eagerness with which they accept the agreements is any sign, glad to do—glad, in fact, to be able, if called upon to strike, to say "We cannot."

The working of this system at all the stations of the South Metropolitan Gas Company has been so satisfactory since its introduction in 1889, that the Directors, after full consideration, and consultation with all their chief officers, have increased the rate of bonus from 1 per cent. on salaries and wages for each penny reduction in the price of gas below 2s. 8d. per 1000 cubic feet, to 1½ per cent., until the bonus amounts to 9 per cent., which it will do when gas is sold at 2s. 2d. per 1000 cubic feet, and then, for each further penny reduction, the 1 per cent. per penny will be reverted to. But there is a condition accompanying this increase. Hitherto the entire annual bonus has been payable in cash on a week's notice, although nearly half the men every year leave it in the Company's hands at 4 per cent. interest. Now only one-half of the bonus can be taken in cash; the other half must be invested in the Company's ordinary stock at the market price—thus making all the employees shareholders. This investment is made in the aggregate in the names of three Trustees; but when the amount standing to any man's credit is sufficient to give him an independent allotment of £5 of stock, the market value of which is about £13—that is, when his accumulated half bonus, or anything he may add to it, amounts to £13—he will be registered as a shareholder in his own name.

Convinced as I have been of the great advantage both to the Company and the employees—to capital and labour alike—of this system, I have waited nearly five years before bringing it before my colleagues on the Board of the Crystal Palace District Gas Company, the only Company other than the South Metropolitan of which I am a Director; but after this practical experience, I felt it my duty to suggest that the system of profit-sharing should be adopted, with the result that in March last the employees were called together, the matter was fully explained, and it was offered for their acceptance or rejection as they might choose. They were told that unionists and non-unionists alike were perfectly free to accept the scheme or not, and that it was not a condition that any man should either leave the Union or be in any way required to accept. Every man was left perfectly free individually to do as he pleased. They were told that no pressure would be brought upon them to take a good thing if they did not approve of it. The condition as to the agreements was also fully explained—that the signing of them would, while entitling them to the bonus, take away their power to strike. Well, every man whom the Company could accept signified his wish to sign an agreement, and to do

it at once. But on being told that the signing would be extended over some weeks, in order to make the agreements expire at different times, the men understood it perfectly, and met the announcement with a good-natured laugh; and now they have signed to a man.

The scheme is as follows: The initial price of the gas has been fixed for this purpose by the Directors at 3s. per 1000 cubic feet; the selling price is now 2s. 9d., which will give a bonus of 3 per cent. on salaries and wages for the year ending on June 30 next. The initial price was fixed at 3s., because it was felt that, to give the thing a start, the first bonus ought not to be less than 3 per cent.—it ought, in fact, to be sufficient to make it worth acceptance by the men in order to get a good start; and this has been the result. For every penny at which gas is sold below 3s., those employees who have signed agreements are to have an annual bonus equal to 1 per cent. on their total salaries or wages, exclusive of piece-work or overtime, until the bonus amounts to 6 per cent., which will be the case when gas is sold at 2s. 6d. per 1000 cubic feet, and then the increment of bonus is to be at the rate of one-half, or 10s. per cent. per penny reduction, in accordance with the following scale:—

Price of gas	3s. 0d.	No bonus.
,,	2 11	1 per cent.
,,	2 10	2 ,,
,,	2 9	3 ,,
,,	2 8	4 ,,
,,	2 7	5 ,,
,,	2 6	6 ,,
,,	2 5	6½ ,,
,,	2 4	7 ,,
,,	2 3	7½ ,, and so on.

Only half of the annual bonus is payable in cash, or it may be left in the Company's hands at 4 per cent. interest, or it may be placed in the hands of the three Trustees for investment in the Company's ordinary stock, and the other half must be invested in that stock by the Trustees; but when the holding of any man amounts to sufficient to purchase £5 of stock, a transfer will be made to him. A Committee consisting of fourteen members, seven of whom are nominated by the Board—two being Directors, the Engineer, the Secretary, the Works Manager, the Chief Inspector, and the yard foreman—and an equal number of representatives of the workmen, nominated by themselves and elected by ballot, has been formed to frame the rules and to work the scheme.

I know of no way but this of placing the relations of capital and labour on a satisfactory footing; and, after five years' experience, I confidently recommend it. The relations are entirely changed from anything in my former experience. The good-will of the men has been gained; and mutual confidence, without which everything must fail, has been established. As a conclusive proof of confidence, I may state that the South Metropolitan Company now hold nearly £40,000 of the workmen's money voluntarily placed in the Company's hands. The men can be spoken to, and questions discussed with them, with an entire absence of the feeling that they regard with distrust everything said, which was very much the case formerly. The system of profit-sharing creates identity of interest between employer and employed; and thus turns the flank of Trades Unionism of the unreasonable and objectionable kind. It also encourages thrift, and enables workmen to become capitalists; and thus turns the flank of Socialism—a most important move, and the best means of dealing with that very mischievous and, if it could succeed (which it cannot), most disastrous doctrine.

The following extract from the evidence of that apostle of Socialism, Mr. H. M. Hyndman, given before the Labour Commission, and which, singularly, is the finish of the whole of the evidence, explains the position of Socialism in regard to capital:—

8718.—Mr. LIVESEY: You are opposed to the capitalist system?—I am.

8719.—Do you object to thrift on the part of the working classes, and to their thus becoming small capitalists?—I do, certainly. I think they only intensify the competition and fortify the class which they should endeavour to supplant.

There are two difficulties that stand in the way of profit-sharing and its development. One is, that it entails a certain amount of trouble to work it properly; to which the answer is that any such trouble is repaid a thousand-fold by the good it does to the employees and the good feeling promotes. What is such trouble when compared with the very real trouble and anxiety which ordinarily exist? The other imaginary difficulty is the cost. It can be most justly argued that the employees of gas undertakings are well paid, and that there is no reason for an increase, which is quite true, except for a *quid pro quo*. Here let me relate the following conversation. A short time ago, I met a friend in Westminster who introduced me to his companion, the Chairman of one of the largest engineering establishments in the North, who at once began on profit-sharing; stating that he had followed the South Metropolitan experience with great interest, but asking what could be done where there were no profits. To this I replied that the profit-sharers produced all that they thus obtained, by their improved working—that in our case their average receipts under this head had been about 5 per cent. on their wages; and I said: "You will admit that a cheerful, contented workman is worth 5 per cent. more to his employer than one of the ordinary sort;" to which my interrogator immediately responded: "Five per cent.? Say 20." I said I could not go so far as that, but certainly the five was not over the mark; and I now say that the whole amount paid by the South Metropolitan Company by profit-sharing has been created by the better working of the men, in proof of which, see the carbonizing wages of the three London Companies in Field's "Analysis." The advantages of profit-sharing are, therefore, worth all the trouble, which, after all, is very little when taken up in the right spirit; and instead of costing anything, it is a source of profit to the undertaking that adopts it.

I can say no more in advocacy of profit-sharing, but would conclude by drawing attention to the fact that, of all industrial questions of the day, the relations of capital and labour occupy the first place. If they are not—and, speaking generally, they are not—satisfactory, industrial prosperity is in serious jeopardy; and all who can help in putting the matter on a better footing have a duty to do which they will neglect at their peril.

If employers will meet their men half way, by doing what they can to ensure to the employed their fair share of the joint product, and doing it in such a way as shall encourage thrift, and give the employed a direct interest in the prosperity of the business by which they live—thus practically showing that they are justly and sympathetically dealt with—while there will still be difficulties to be overcome, and disappointments and discouragements to be met as men should meet such trials, there is no doubt that such action will meet with a corresponding response, and a new and happy era will be inaugurated. Will the gas undertakings of the kingdom seize the opportunity that is ready to their hand, and take the lead in showing the way to secure satisfactory relations between capital and labour?

There is, however, a higher motive than self-interest, or even than patriotism. Employers and employed form part of the great human family—children of the same Father, and therefore bound by the highest ties of duty mutually to help one another. Moreover, in this land they cannot plead ignorance of Christ's Golden Rule, which sums up the whole matter, and is the only real and certain solution of the difficulty: "As ye would that men should do to you, do ye also to them likewise."

Discussion.

The PRESIDENT said there could be no better way of testifying their appreciation of the able paper they had just heard than by thoroughly discussing the subject which it treated so admirably. There was nothing in connection with gas-works management which required more careful consideration than the labour question.

Mr. C. GANDON (Lower Sydenham) said he could bear testimony to the cordial way in which the new system had been received at the works of the Crystal Palace District Gas Company. At first there seemed to be a little mistrust among some of the men; and he believed the Gas Workers' Union had, by Mr. Thorne, come down to the works and inquired about it. He did not, however, think Mr. Thorne advised the men not to sign. At any rate, when the agreements were ready, the difficulty was to prevent all signing at once. For the reasons explained in the paper, it was considered better to spread the signing over a certain time; and no objection was made to this. The system had only been in operation since March last; and therefore he could not say much with regard to the working of it. But his opinion was that it would be a decided

success, and be to the benefit of the Company. He should be much surprised if this scheme, or a somewhat similar one, was not generally adopted.

Mr. G. C. Trewby (London) remarked that he had not had any experience of the working of the profit-sharing system; and an ounce of practice was worth a pound of theory. He was only too glad, however, to find from Mr. Livesey that he, from the experience of the last four years, had such confidence in it as to recommend it to the Crystal Palace Gas Company; and he hoped they would hear something more from them in due time. One or two questions occurred to him with reference to the winter men. He thought the winter stokers were about two-thirds of the total number; and the question was how to accommodate this profit-sharing business to them. These were the men who always gave the greatest amount of trouble. He should like to know whether the price of gas on which the profit-sharing depended was taken as the price to the ordinary consumer, or that charged to the public authority; because some companies made a considerable difference, and he could quite understand that, if this were not specified in the agreement, it might give rise to misunderstanding—the men might claim to have their bonus regulated by the lower price. Mr. Livesey said the whole of the profit had been created by the better working of the men; and he compared the carbonizing wages of the three London Gas Companies. But he (Mr. Trewby) did not see how he proved that. How was it that the low carbonizing wages on the part of the South Metropolitan Company proved that his men were working better than those of the other two Companies? Without information as to the amount of machinery in use, such a comparison would be fallacious. It might be that the South Metropolitan Company had introduced machinery to a larger extent than the others; and therefore the wages would be necessarily lower. They were much indebted to Mr. Livesey for having brought forward this subject, as anything that could engender a better feeling between employers and employed ought to be adopted. In the case of his own Company, it was pretty well known that some time after Mr. Livesey had fought his battle, and had a new set of men in, they were not satisfied, but wanted to make the works Union works, where no one should be employed who did not belong to the Union. Although the Chartered men were under a month's agreement, it was openly stated that, at some period, they would throw down their tools without any notice whatever. This was met, on the part of the Company, by the introduction of what they called "contingency buildings," which they had at all their works, and which were now made into permanent buildings, for the purpose of housing the whole of the men who might be required to carry on the gas-works in case such a threat were ever carried out. This was a very unsatisfactory state of things; but it was a necessity. The Company thought that, as they had the lighting of a very large portion of London in their hands, to ensure it was their duty to use every possible means that the lighting should be continued; and it seemed to them the only way to do so was to protect their men. Although the Union might order the men to turn out, it was a great question whether they would do so. But they would require protection; and the only way this could be afforded was by keeping them in the works. This was done at considerable expense; and it seemed to him that, if this experiment of Mr. Livesey's were satisfactory, such means would be unnecessary.

Mr. A. F. Browne (Rotherhithe) said he had to pass through a somewhat trying experience in the year 1889; and the difference between the conduct and the feeling of the men which he now saw from day to day, and that which he used to see before the strike, was very strongly marked. It appeared to him that there was a high appreciation on the part of the men of all that had been done for them in connection with the profit-sharing scheme, and a feeling of confidence between them and the Company certainly did seem to exist very thoroughly at the present time. They found that the men were anxious to take up the agreements. At the outset, perhaps, there was a little hesitation on the part of some, who possibly had a leaning towards the Union. At Rotherhithe, there were a considerable number of men who had been with the Company before the strike, and who were taken back with the full knowledge and approval of the Chief Engineer and the Directors; and they had had no trouble with them since. There was perhaps, in the case of some, a little disinclination at first to sign the agreement containing a clause stating that the holder was not a member of the Gas Workers' Union; but this hesitation had now entirely passed away. The agreements were for varying periods, and expired on different dates. They had adopted, as far as practicable, the principle of giving every man an agreement for whom they could see a period of three months' service possible. At one time he limited the duration of an agreement to three months; but this was rather with the view of giving every man he possibly could the benefit of it, and showing no favouritism. Latterly they had resorted to the plan with which they commenced, of issuing an agreement for as long as six months; in some cases he believed it extended to twelve months. The great effect was that the men were satisfied and happy to feel that they had a period of three months' certain work. The system of workmen's representatives had answered exceedingly well. At the Rotherhithe works, two men were elected by ballot, to whom were referred all sorts of questions which the men did not understand; and, as a rule, they were settled by these representatives without coming to him. At times, some reference was made; but in most cases he let these representatives settle all questions connected with the explanation of the working of the scheme without interference. Mr. Livesey had not referred in his paper to one important point, and that was as to how well this had worked in the case of accidents. Perhaps this was rather too large a question to enter upon. But, as far as they had had experience at Rotherhithe, it had succeeded beyond all expectation; and the feeling of confidence which existed, as far as he could see, tended to increase rather than diminish.

Mr. Denny Lane (Cork) said he had not had any experience of the working of the profit-sharing system; but there could be no doubt that community of interest should produce in this case the same happy results as it did in domestic matters. There might be as great divergence about the comfort of life in a gas-works as there might be in domestic relations, depending upon whether there was good feeling and affection on both sides or the opposite. But there were one or two points to which he should like to refer. In the case of the South Metropolitan Company and many others, there was a sliding-scale, under which the profits increased as the price of gas was reduced; and therefore the reduction of the price of gas had a double-barrelled effect. It was to the benefit of the proprietors and of the workmen also. But in the case where there was no sliding-scale, what would be the effect on the men if the Directors should propose to reduce the price of gas? Circumstances might arise where it would be a permanent benefit to the shareholders to incur a temporary loss by a reduction in price; and in such a case it was only natural to suppose that the men would object to any such reduction as would affect their immediate interests, when they did not see how it would help their future prospects. Another question had already been raised, as to how to deal with the stokers employed only in the winter. In the gas-works at Cork, these men had the preference for outside work, yard work, and so on, and at rather higher wages than other men; but there seemed to be a little difficulty about this with regard to the annual agreements. He would ask whether it would be possible to devise a profit-sharing system by which the profits would be increased as the cost of labour diminished, so that they might say to the men: "You shall have so much a ton, if you carbonize at a certain price; for every penny under that you shall have an increase in profit." This would make the sliding-scale not depend on the profits generally, which might depend on the price of coals, of residuals, and on many other circumstances, but would make the men directly interested in that portion of the company's operations which was in their own hands.

Mr. F. Livesey (London) said he had found the profit-sharing scheme very successful. They now knew what was going on through the members of the Committee. If there was any little difficulty among the men, they went to these committeemen first; and they soon let the officials know if they could not settle the difficulty themselves. The general working of the whole arrangement was most satisfactory; and their relations with the men now were very different from what they were at one time. No one who had once tried it would ever want to go back to the old system.

Mr. J. West (Manchester) said there could be no doubt that any system which had the effect of bringing employers and employed together would be of great advantage to the gas industry. The bitterness which had existed in days gone by was much to be deplored; and those who were mixed up in it, and had any heart in them, must rejoice to find any system which would bring about a better state of things. He had had several opportunities of seeing the South Metropolitan men at work; and they appeared to him to be working with a will and a determination, and to be thoroughly contented. Speaking of gas-works generally, he did not think there should be much difficulty in arranging for profit-sharing. They knew the amount of work that had to be done throughout the year, and they had some idea of the profits which might be derived from it; but he did not think this would apply to ordinary business. In the Manchester district, they had thought a system of this kind desirable; but they could not see the way to bring it about. In the engineering trade, there was a very strong Union; and the men had fully made up their mind what they would accept, and there was not very much chance of fighting them individually. He could not set an example, as Mr. Livesey had done. It would have to be carried out bodily by the whole of the employers taking it up against the Trade Union, or they must meet together and bring about some amicable system, which probably would be of great advantage to the country generally. He could not quite see how this system was to be introduced in connection with corporate bodies; and he should like to know whether Mr. Livesey had thought out this matter. He could not take the gas department by itself—he would have to include all other departments; and inasmuch as they now had a large proportion of labour candidates coming on the various Boards, he did not know whether they would not drive Socialism a little bit too far. Of course, the principal point for gas engineers to consider was what was to be done in connection with gas companies; and he felt, now that they had some facts to go upon, and that a system had been introduced and been worked for five years successfully, that there was every encouragement for others to adopt it.

Mr. T. S. Lacey (Pimlico) wished to ask Mr. Livesey whether in the comparison he had made respecting the working of the various London Companies, he had taken into account the different hours worked. His Company had granted the eight-hour system to all the men in the carbonizing department; but some of the other Companies worked twelve-hour shifts. He did not mean to suggest that the mere cost of the labour was a question of immense importance with regard to this matter, because everyone could see that, even if the profit-sharing system were to involve a slightly increased cost, the advantages it afforded would more than counterbalance it.

Mr. G. E. Stevenson (Manchester) thought there might be difficulties under this system in connection with the reduction of the number of men or the dismissal of individuals; and he said he should like to hear if any such difficulties had occurred. Again, what was the possibility of such a system being adopted by corporations? He imagined there would be a little difficulty to contend with, first of all as to the auditors' accounts, and so on, in dealing with the expenditure. But, apart from this, it was very certain that in the present day there was more pressure brought to bear on corporations on behalf of the men, and in regard to making concessions to them, than on the companies; at any rate, that was very much so in Manchester. There was constant pressure being brought upon them to improve the position of the men; and one way in which the Corporation had endeavoured to attack the men to their work had been by establishing a thrift fund. This was quite different from profit-sharing, and by no means a complete solution of the difficulty; but, even in connection with that, some troubles were found in dismissing workmen. They were obliged to advise the Town Hall authorities that they should not accept men as members of the thrift fund unless they were such as they could recommend as permanent and satisfactory workmen.

Mr. J. F. Braidwood (Greenwich) said he had not experienced any of the difficulties to which reference had been made. He did not let everyone sign an agreement, but only those of whom they approved. There was a very much better feeling existing now than there ever had been before. As he went round among the men, he was cordially received; whereas before he was simply scowled at, and it was a misery to go through the place. The men were getting to understand and appreciate the benefits of the system; and he should be very sorry indeed to see it discontinued.

Mr. J. Tyson (East Greenwich) said his experience of the system had been most favourable. He was sometimes asked whether he could point out any individual man who worked better than he was in the habit of doing previously. He could not say that he could do this; but he felt convinced that, taking the men as a whole, they must be the better for the system. It was an arrangement for their own benefit; and they must, of necessity, do their work far better when they felt that it was to their interest to do so. With respect to the investment of the money, during that very week the men had been sending in their statements as to whether or not they would accept their bonus for the present year on the new or the old scheme—that was to say, on the 4 per cent. or the 6 per cent. basis; and the great majority had elected to take their money on the 6 per cent. basis. This showed that they thoroughly understood the matter, and were anxious to fall in with the views expressed by Mr. Livesey.

Mr. S. Glover (St. Helens) asked for further explanation of the phrase "exclusive of piece work or overtime," which, he said, he did not quite understand.

Mr. W. Foulis (Glasgow) said they had an arrangement under which agreements were signed; but then only the best men were allowed to enter into them, and these men only for a fixed time—three, six, or twelve months. The agreements were not in any way forced upon the men, and were only made with men who really had a recognized position. The condition was that, if they concluded the term of the agreement without any fault being found, they received a bonus equal to 1s. per week during the time the agreement lasted. They found this plan very beneficial. The men worked very pleasantly; and their great effort was to obtain such a position on the works as would entitle them to an agreement. They looked upon it as a privilege. The difficulty he always felt in connection with profit-sharing was that the price of gas depended on so many circumstances which were quite beyond the control of the workmen. If, as Mr. Denny Lane had suggested, it could be made more dependent on the items of cost, over which the men had some control, it seemed to him that it might be more easily worked. The great thing was to give the men the security of steady employment, and some recognition of good behaviour.

Mr. C. C. Carpenter (Vauxhall) said he would give the results of his practice. They had not at present been working machinery; but, in taking out the carbonizing wages for 1892 and 1893, he found that the reduction in cost per ton was as nearly as possible 1¼d. For the past two or three years, they seemed to have been working in almost identically the same way as regards carbonizing. They made about the same quantity of gas per ton of coal; and there was hardly any other change to be noted. What, then, was the cause of the reduction in the cost in carbonizing? It might be said that he spent more time in the retort-house, and looked after things better. But this did not happen to be true; for last year he was very busy in other ways—in carrying out extensions and in making experiments—so that he spent less time than usual in the retort-house. He therefore thought he was quite justified in attributing this reduction in cost to the fact that the men had done their work better. They had done it better because they were in a more contented and happy frame of mind, and because they knew that the better they did the work, the lower would be the price at which the gas could be sold, and the more money they would get in the shape of bonus. It was impossible, by supervision, to keep up the standard of retort-house work. One retort alone, in the course of a year of working fully, was charged from 1300 to 1400 times; and multiplying this by the number of retorts, it was obviously impossible to look after every charge. One must depend upon the men; and the more one could get them to be depended upon, the better it would be for the undertaking as a whole. Some reference had been made to the difficulty of getting rid of a man who had signed an agreement. That difficulty might crop up occasionally; but it did not affect the majority. The majority were not black sheep or bad workers; and if one did get caught once, it was perfectly easy to so arrange matters as not to be caught a second

time. Another gratifying point about this system as a whole was the arrangement by which men could become shareholders. It was not an uncommon experience for him, while going about the works, to have a stoker, or an engine driver, or a labourer, come up, and, taking a dirty book out of his pocket, ask him if he had not enough to take out one share. If, on looking through the book, he found he had, the man in due course had £5 of stock allotted to him. The more this system could be increased, the better workmen they would have, and the better it would be for the welfare of the industry as a whole.

Mr. CHARLES HUNT (Birmingham) said he had not had any experience on this subject; but he should like to add his meed of thanks to the author for the most interesting account he had given of his success in his profit-sharing scheme. He was inclined to agree very largely with his view that the relations of capital and labour in the future would be on the lines he had indicated, although progress in this direction would be very slow. Mr. Livesey seemed to think that the men generally were imbued with the objectionable notions which he had quoted from Mr. Hyndman; but in this he (Mr. Hunt) could not agree with him. He did not think these ideas had any firm hold on the working men of England. As regarded the gas stokers, it seemed to him that they simply took Occasion by the hand, and sought for all they could get when the opportunity served. At all events, at Birmingham the socialistic leaders had no hold upon them. They addressed comparatively small audiences, which were not composed of representative working men. Mr. Livesey would probably answer Mr. Denny Lane's difficulty by suggesting that he should adopt the sliding-scale; and he (Mr. Hunt) should agree with that answer. But the difficulty he saw was what Mr. West had pointed out with regard to corporations. If a corporation official were to propose to convert the present maximum wage into a minimum one (which was the effect of the adoption of this profit-sharing system), what chance would he have on any Town Council in the kingdom? A proper application of this system would be to revise the present rate of wage, and to fix a new maximum wage—probably lower than the present, but rising to a higher scale if the conditions were properly worked out. But then came another difficulty. The great movement of the last twenty years had been towards not only an increased wage, but a reduction of hours; and how was this met by the profit-sharing scheme? If he were rightly informed, the South Metropolitan Company worked under the old twelve-hour system, which was, no doubt, by the choice of the men; and he did not say anything against it. But when the time next arrived, as it assuredly would, for a further reduction of hours, how would this affect Mr. Livesey's scheme? Of course, it was easier to suggest difficulties than to overcome them. However, he did not suggest difficulties for the purpose of "throwing cold water" on the scheme, with which he was much in sympathy; and he hoped Mr. Livesey might have in his mind some suggestions which would meet the difficulties of corporations taking up the system.

The PRESIDENT said the Institution was to be cordially congratulated on having received from Mr. Livesey—an acknowledged leader on the labour question—so valuable a contribution to their proceedings. Like Mr. West, he should be interested in hearing how Mr. Livesey proposed to apply the system to corporation works; for he feared there would be great difficulties in this direction. Before calling upon Mr. Livesey, he begged to offer him, in the name of the Institution, his best thanks for his paper.

Mr. LIVESEY said he would endeavour to answer the questions *seriatim*. With regard to the winter men, they met the difficulty by allowing them to sign for any period not less than three months. They received on leaving the same bonus as the regular men, or they could leave it with the Company at 4 per cent. interest. Under the new regulation of increased bonus, they told them that, if they wanted their bonus in full, they could have it at the old rate of 1 per cent. for every penny reduction, or 4 per cent. according to the price of gas at present; but that if they liked to have it on the other basis, of 1½ per cent. per penny of reduction, or 6 per cent., they could have it on the same conditions as the regular men. That was to say, on getting a note from the foreman to the effect that they were eligible for employment next winter, they could have the 6 per cent. bonus; but half of it must be left in the Trustees' hands. If the men had worked for four months, the bonus they would have was calculated on the four months' wages, whatever they might be. Another question put by Mr. Trewby was as to whether the profit-sharing depended upon the price of gas to the public authority or the general consumer. In the South Metropolitan Company, there was practically only one price; but he should say it must be the price to the general consumer—not any special price made for exceptional circumstances. If once they went into the question of differential prices or discounts, there would be no end of difficulty. Then as to the cause of the difference in the cost of carbonizing. There was considerable difference in the cost per ton of coal in the case of the South Metropolitan Company and the other Metropolitan Companies. They might be considered parallel cases, as they were under the same Official Auditor, and the accounts were made out in the same way. The carbonizing cost in the South Metropolitan Company was considerably less than in the other two Companies. Part of the difference might, no doubt, be due to machinery; but this could not account for anything like all. They had gone into it very carefully, and found that, whereas before the advent of the Gas Workers Union there was a slight difference between the two Companies, now it was very marked—in fact, the difference in carbonizing wages was more than the whole amount paid to the profit-sharers. Of course, it was not all due to their better working; but he was quite sure that certain portions were. Two or three years ago, they had a week of fog. The stock of gas was low; and the gasholders at night were empty. He asked the foreman how the men were working. He was a man not inclined to take too favourable a view of workmen generally; but he said they could not be working better. They were cramming in every ounce of coal the retorts would carry, without being asked to do so; and at the end of the week, the heats were as good as at the beginning. Of course, the general result of cramming coal into the retorts was, that after a day or two, the heats went down. In this case, however, the men saw the difficulty, and met it cheerfully. They did not get anything extra for it, and did not expect it, as it was part of their duty. This was one instance of the cheerfulness with which the men on this system did their work. That was appropriate to what Mr. Tysoe had said. There were cases in which men came with various suggestions as to how things might be cheapened and improved; but the chief point was the cheerfulness and good-will with which the men worked. To show there was this reserve of power, he (Mr. Livesey) might give as an instance the Thames Iron-Works, where Mr. Hills had introduced what he called the "good fellowship" system—he made all the men partners in the contracts. In taking a contract for (say) a cruiser, he put so much for the ironwork and so much for labour; and he said, in effect: "If you can earn in a month what ordinarily will take you five weeks, you will have the pay of five weeks for a month's work." These men had increased the value of their work by about 17 per cent.; showing what was possible when their heart was in their work. As Mr. Browne had remarked, it was regarded as a privilege to sign these agreements—the men were most anxious to sign them; and, as Mr. Gandon had said, the men at the Crystal Palace Gas-Works took up the scheme, and were so anxious to adopt it, that they were all willing to sign immediately. He did not think this was with the idea of signing all at once, on the Union system, but simply the result of their eagerness to take advantage of the benefit offered. What each man felt was that he was secure under this agreement for twelve months' work. Regarding the difficulty of getting rid of the men, which was raised by Mr. Stevenson, as Mr. Braidwood had said, this arose so seldom that there was practically no difficulty in it—in fact, the cases were so very few and exceptional that it gave no trouble whatever. Mr. Browne had also mentioned the question of accidents. They had adopted the system of inquiry into all accidents. A jury of workmen investigated every accident which took place, involving injury either to one of the men or to property. This had been going on for about eighteen months, with the most satisfactory results. The men were asked the cause of the accident, and also to make any suggestions whereby to avoid similar occurrences in future. The result was that 90 per cent. of these accidents had been found to be the fault of no one. There had been one or cases where it had been, to some extent, the fault of the foreman, and a

few also where the jury had brought in a verdict saying that it was the workman's own fault. He had looked over the records; and he was bound to say they had dealt fairly—more fairly than an ordinary jury would—and the greater part of the accidents were pure accidents for which no one was to blame. It was for these, he maintained, that provision should be made; and all these things tended to improve the relations between employer and employed. Mr. Denny Lane had referred to those cases where there was no sliding-scale. But, with regard to companies, there would be no difficulty whatever. Any gas company not having a sliding-scale could easily make one for the purpose. If they were selling gas (say) at 3s. per 1000 cubic feet, they might say: "We will take 3s. 3d. as the starting price, and give you 1 per cent."—or whatever percentage was agreed upon—"on your wages for each penny at which we can sell the gas below 3s." In all companies where there was no sliding-scale, it was certainly to their interest to reduce the price, although not so directly, perhaps, as with the sliding-scale companies. But all gas companies were now agreed that it was desirable to sell gas as cheaply as possible; and they could adopt this principle with their employees without any Act of Parliament—in fact, it was only doing what the South Metropolitan and Cystal Palace District Gas Companies had done. They did not take the price fixed by Act of Parliament as the initial price for the workmen; they took an arbitrary figure, and companies (sliding-scale or not) could work on these lines. The winter men, as he had already said, were placed on the same footing as the regular men. If a man worked in the winter as a stoker and in the summer as a yardman, his bonus was calculated on the wages he received as a stoker for six months, and on those received in the yard for the other six months—in fact, on the wages actually received. And here he might deal with Mr. Glover's question about piecework and overtime. They took the daily rate of wages as the basis, because it was much more simple. He did not think it was fair to take into consideration overtime and piecework. The purifiers were emptied by piecework; but those men were all rated at a certain daily rate for the purpose of profit-sharing. The Accountant who had to deal with it put down "Smith, 52 weeks, at so much a week"—his regular rate, giving him the benefit of absences on account of sickness, if they did not exceed a certain amount stated in the rules. Mr. Denny Lane's suggestion that profits might increase as the cost diminished, was very good; but he was afraid it was hardly practicable. He did not see how it could be worked out with the simplicity of the sliding-scale basis. Then they were met by Mr. Foulis's objections, that the cost of making gas did not depend to any appreciable extent on what the men could do, compared with the coal and the residuals markets. This was quite true; but he did not see why the workmen should not be placed on the same footing as the shareholders and the consumers. They benefited by a fall, and lost by a rise in the coal market; and the workman had just as much right to benefit by these fluctuations, or to suffer loss, as the shareholders, so far as profit-sharing was concerned, but not as to their wages. Mr. West put a poser as to how corporate bodies were to work the system; and he (Mr. Livesey) must confess he could not answer the question. There the companies had great advantages over them. There were many difficulties—not the least being that corporate bodies were not so anxious to reduce the price of gas as companies. They might, by keeping up the price of gas, set aside a large amount in aid of the rates; but the workmen would say: "You are robbing us in order to help the ratepayers." He (Mr. Livesey), however, believed in this, that, like other things, where there was a will there was a way. If any Corporation like that whose gas-works were managed by the President would take up the matter, he thought a way could be found for dealing with it. There was no necessity for profit-sharing to follow any hard-and-fast rules; it must be adapted to the varying circumstances of each case. The difficulty was with the corporations themselves. No doubt Mr. Colson could do it very easily as far as the gas-works were concerned. Mr. Lacey had asked a question about the eight and twelve hour systems. They were working on all sorts of systems. At Vauxhall it was the eight-hour system exclusively; at East Greenwich, the two-shift system—though not anything like twelve hours, but about ten-and-a-half hours; at the Old Kent Road, on the eight-hour system exclusively; at Bankside, on the two-shift system; at the Old Greenwich (Mr. Braidwood's) works, on the two-shift system; at the Rotherhithe (Mr. Browne's) works, they were on two shifts in the winter and three in the summer. Consequently, they had an excellent opportunity of comparing the cost under the two and three shift system. If the men worked on the two-shift system, they received increased pay exactly proportionate to the work they did; and he believed Mr. Browne found that working on the eight-hour system was quite as cheap as the twelve-hour.

Mr. Browne said there was a very slight difference against the eight-hour system, due to the 1s. 6d. per week good-time money being given in both cases.

Mr. Livesey said it was evident, therefore, that the saving was not due to any difference of system. When attending the Labour Commission, he got out of their socialistic friends what they would do when a fresh crop of unemployed rose up under the eight-hour day. They said they would then go for six hours; and when a fresh crop of unemployed appeared, they would go for four hours, and would compel everbody to work for four hours—the inhabitants of Belgravia just as well as the workers at the docks. Mr. Hunt had made some very pertinent remarks, and said the progress would be slow. Perhaps it would; but it depended on the members of the Institution to accelerate it to some extent. He quite agreed with Mr. Hunt that English workmen were not, as a rule, imbued with socialistic notions. The best evidence of this was the eagerness with which they were ready to fall into the very antithesis of Socialism by becoming shareholders; and the fact that their men had accumulated nearly £40,000 in the course of four or five years was a proof that the socialistic doctrines of Mr. Hyndman did not prevail among these working men. He was astonished to find that so many as 44 per cent. left their bonuses in the Company's hands, as he did not expect to find so much thrift as that. The way to meet these socialistic notions was not so much by argument as by practice, by giving people the opportunity of becoming capitalists; and the way to deal with difficulties when you had them was to face them. In their experience, all the difficulties which had been raised—and he quite appreciated the points which had been put—had been met simply because there had been an earnest desire to meet them. The Committee—consisting of Directors, the chief officers, and the foreman, with an equal number of workmen—had all shown a determination to meet the difficulties; and, as a result, they had vanished.

GAS-WORKS EXTENSIONS IN STOCKPORT.

By S. Meunier.

The title of this paper may be considered to be somewhat of a misnomer, as in addition to the description of the various extensions which have been carried out by the author, it was thought it would add somewhat of interest if the alterations in the original plant, although perhaps not of great importance in themselves, were also dealt with.

The Stockport gas undertaking was originally promoted in 1820; a Company being formed with a share capital of £10,000 in 200 shares of £50 each. The first works were established in Millgate; and the Company carried on their business without legal protection from August, 1821, to 1825, when they obtained an Act of Parliament to legalize their proceedings. In 1837, soon after the election of the Borough Council, the Corporation applied to Parliament for increased powers, and obtained an Improvement Act, which contained clauses empowering them to purchase the existing gas-works, or to establish new ones. Ultimately, after many meetings, it was decided to buy out the Company, in preference to erecting new works; and in September, 1838, the Council entered into an agreement for this purpose—the price being £21,493 10s., which included two works, mains, pipes, and stock. The undertaking has since been carried on under this Improvement Act, which confers great powers upon the Corporation.

In March, 1891, when the author took over the management of the undertaking from his predecessor, the manufacturing plant was distributed among three works—viz., Millgate, Heaton Lane, and Portwood. A brief description of these works, as they were at this date, may not be considered out of place.

At the Millgate works, built in 1820-21, there were five

beds, 9 ft. 6 in. wide, containing in each five 24-inch by 16-inch through retorts, Ω-shaped, 20 feet long, built up in the centre with a 14-inch wall; the floor of the retort-house being 13 ft. 9 in. below the ground level of the yard, and the coal-stores immediately under the yard. All the steam required was raised by one egg-ended boiler, 3 ft. 9 in. diameter by 10 feet long, set at the end of the retort-bench; and a single exhauster, of the horizontal reciprocating type, was fixed in a room entered directly out of the retort-house. The condensers consisted of 6-inch diameter vertical pipes; the circular scrubber was filled with brickbats; and there were four small purifiers worked by means of a centre-valve. The gas made here (equal to about 230,000 cubic feet per day) could be sent to either of the other works, as required, through an independent main.

The Heaton Lane works were erected in 1834; and the retort-house contained thirteen beds, each 8 ft. 6 in. wide, set with seven 22-inch by 15-inch Ω retorts, 19 feet long, built up in the centre in a similar manner to those at Millgate. The coal-stores, of large capacity, were so designed as to allow of all the material being unloaded direct out of the carts and stacked to a height of 20 feet without throwing up. There were two Lancashire boilers in use, about 5 feet in diameter and 15 feet long, and two exhausters, both of the vertical reciprocating type. One of these, however, being too small to conveniently take the gas from more than five beds, the work during the winter had always to be done by the larger one. The condensers were similar to those at Millgate—the pipes being 6 inches in diameter; but the two scrubbers, each 10 feet in diameter and 30 feet high, were filled with boards on edge. The set of four purifiers, each 19 ft. 3 in. by 14 ft. 3 in., and 6 ft. 6 in. deep, were arranged on a floor 11 feet above the yard level; the lime being slaked beneath, and then taken up by means of an ordinary bucket elevator fixed at one end of the purifying-house—the spent lime being afterwards wheeled out on the higher level to a shed specially built at the end of the house. The make of the gas at this station equalled about 900,000 cubic feet per day; and the storeage capacity of the two holders about the same. The governor was a 24-inch one, of the ordinary pattern, working with a cone valve.

The Portwood works—the latest, and now the largest works belonging to the undertaking—were built in 1877-8. They were very similar in design to the other works. The retort-house, 145 ft. 6 in. long by 64 feet wide, contained twelve beds, each 9 ft. 4 in. wide, set with five 26 ft. by 15 ft. Ω retorts, 19 ft. 3 in. through, built up in the centre. The hydraulic and foul mains, with their various connections, were practically a reproduction of the same portion of the plant at the other works. The overflow of tar and liquor was taken off at the end of the hydraulic main, and led direct from a seal-box fixed on the retort-bench to the storeage well. The gas was taken from the top of the hydraulic main by means of a special casting into 10-inch diameter cross-pipes, and so into the 20-inch cast-iron foul main, which ran all round the outside of the retort-house, and thence underground at the nearest point to the condensers. The main flue was much larger than is usually constructed, being 7 feet high by 4 ft. 6 in. wide; another feature not generally found being the large smoke-shafts, 23 feet high, 18 feet long, and 14 ft. 6 in. wide, of which there were four, and which experience has shown keep the retort-house very clear of smoke and steam.

The condensers were of the annular type, and have not so far been enlarged. The exhauster was a double cylinder horizontal reciprocating one, and was understood to be capable of passing at least 80,000 cubic feet per hour. The tower scrubber, 12 feet in diameter and 50 feet high, was filled with boards on edge, as at Heaton Lane; and the liquor was pumped and distributed by means of a small engine fixed at the base.

The purifying-house was 107 feet long and 61 feet wide, and contained four purifiers, each 24 leet square and 7 feet deep, fixed on an upper floor 15 ft. 6 in. above ground-line, formed of cast-iron girders and plates; room being left for two more vessels of a similar size. The purifiers were worked, as at the other works, by means of a centre-valve. The station-meter was of 80,000 cubic feet per hour capacity. The two gasholders (one of which had only been put in work during the winter of 1890-1) gave storeage room for about 2,000,000 cubic feet of gas. The governor, of the same size, and similar to the one at Heaton Lane, worked very badly. The largest daily production at this station had been up to that time about 740,000 cubic feet. The make per ton all round was very high—the proportion of cannel used being equal to about 90 per cent.; and the make per mouthpiece at the various works had averaged about 6000 cubic feet at Millgate and Portwood, and 4900 cubic feet at Heaton Lane.

For several seasons before the author's appointment, the maintenance of a sufficient supply had been a matter of much anxiety and trouble; this being more especially felt during the winter of 1890-1, and the first instructions given him by his Committee were that he should proceed with plans for an extension of at least 400,000 cubic feet of gas per day, so that the department might be enabled to cope with the next winter's demands.

The first step taken was to thoroughly consider how the land at disposal was to be ultimately utilized; and a scheme for this having been decided upon, detail plans were early in April commenced and proceeded with as rapidly as possible. The contract for the brickwork was immediately followed by those for the roof and retort-fittings. But the first contractor only proceeded with the work for one day, when, having found an error in his calculations, he applied to the Gas Committee to be allowed to give up his contract. This they agreed to do, and then handed it over to another firm, who completed it. But in the interval valuable time had been lost. However, by great pressure upon the various contractors, the work was completed; and the first beds were put to work in November, 1891.

The extension was built at the eastern end of the old retort-house, and is necessarily of the same design. The foundation walls, 3½ bricks thick, built on arches 6 ft. 4½ in. wide, are started from a bed of concrete 3 feet thick resting on sound gravel. It was thought advisable, in view of uniformity, to also put in the additional smoke shaft shown, and the same section and size of retorts were also adhered to in the new settings—six, however, being put in each arch, in lieu of five, as in the old beds. The ascension-pipes, hydraulic mains, &c., are different; the former being made 7 inches diameter, reducing at the top to 5 inches diameter, in lieu of 5 inches throughout. The H and dip pipes are likewise 5 inches diameter; the wrought-iron hydraulic, 2 ft. 3 in. wide and 18 inches deep in the centre, and 24-inch wrought-iron foul main, are fixed on cradles carried by the 9½-inch by 4½-inch joist iron ties, 29 lbs. to the foot, which couple up the wrought-iron buckstaves. The gas and overflow liquor come away together to the foul main; but all tar and liquor is taken off from the bottom of this into a seal well at the end of the bench. The seal on the dip-boxes is adjusted by means of a valve of the type now generally used for this purpose. The section of main flue is different and smaller than the one built in the old house, and to which it is connected; being only 4 ft. 9½ in. by 3 feet in the clear. It is entirely free from the 18-inch cross walls of the beds; the weight of these being kept off it by a 9-inch arch. The original intention was to have filled up all the bottom work round the flues with concrete and brickwork in mortar. But as it was felt that such a solid mass would take longer to dry than the available time would allow of, and also as it was thought probable that in the future these beds might be altered to regenerative firing, it was determined during the progress of the work that this space should be filled up with dry bricks pulled out from the old gable wall, packed carefully into place by hand, and all interstices filled up with dry sand; over these a few courses of common bricks were laid in mortar, and finished off with two courses in fire brick and clay.

It may be of interest to describe in what rotation the work was carried out, and how the time at disposal was used. The excavation for the outside walls was proceeded with to the gravel bed, concrete put in 3 feet thick, and the foundations put in to the ground level. Then the earth for the retort-bench was taken out (also to the gravel bed), 1 foot thickness of concrete put in all over, and the cross walls built right up to the springing level of the arches. These were then turned, and, when completed, the main and other flues, together with the filling in, were taken in hand. By that time the special plinth bricks, necessitated by the design, were partly on the ground; and while the Corporation workmen proceeded with the retort-setting, the contractor went on with the walls

of the retort-house. Special means of tying-in the new and old work had to be taken; the bricks in the old house being much larger than any it was found possible to get. The old walls at the point of junction were carefully strutted up; the struts being left in until the roof was in position. Several of the settings were completed some time before the walls were up; and the contractors for the retort-fittings, who had been carefully instructed as to the order in which they should deliver the materials, proceeded to fix them. Such good progress had been made with this particular portion, that the author advised his Committee to allow one of the beds to be put in on the regenerative principle; Mr. Charles Hunt very kindly assisting him by sending a sketch of the system used in Birmingham, and allowing it to be adapted for the purpose. In the meantime, gas making on the works had been entirely stopped; and the Corporation fitters were enabled to lay the necessary mains required for the extension—commencing from the condensers, and working back to the retort-house. The retort-fittings were nearly all fixed before the walls were ready for the roof; but as soon as these were completed, scaffolding was put up, and the erection was pushed on with—the smoke-shaft being left till the last. The first two beds were put to work on Nov. 23, 1891; the others following on rapidly.

In addition to the extension, it was decided to alter the governor at Portwood; this work being put into the hands of Messrs. W. and B. Cowan, and successfully carried out by them.

During the winter of 1891-2, various difficulties were encountered with the old portions of the plant; chief among them being the breakdown of the exhauster. This occurred on two occasions, and practically compelled the author to work without an exhauster for a fortnight at a period of the very heaviest make. In consequence of this, it was determined to lay down an additional one; and accordingly an order was placed with Messrs. Bryan Donkin and Co. for one of 70,000 cubic feet per hour capacity, capable of working up to 80,000 cubic feet if required. It was also found that ammonia was passing forward into the purifiers in rather large quantities at all the works; and it was decided to order washer-scrubbers for the Portwood and Heaton Lane works. The one for the former station, equal to 2,000,000 cubic feet of gas per day, was obtained from Messrs. Clapham Bros.; and the other for the latter, equal to 800,000 cubic feet per day, from Messrs. Kirkham, Hulett, and Chandler.

The arrangement of the foul mains not being, in the author's opinion, altogether satisfactory, tending, as it did, to the too sudden and rapid condensation of the gas, he decided to completely do away with the outside pipes, as they would ultimately be in the way of future extensions, and to replace them with a 24-inch wrought-iron main, fixed over the centre of the retort-bench, and along the inside wall of the retort-house, to the point where the then down pipe was fixed; this also being removed inside the house, and connected through the wall to the underground main outside. This has been found to act very satisfactorily, and has undoubtedly improved the working results.

In addition, three of the old beds which required re-setting were altered from five 26 in. by 15 in. ⌂'s to seven 23 in. by 17 in. ⌂'s, with a consequent gain of about 22,000 cubic feet per bed in 24 hours. The new retorts were all fitted with patent lids. Various other minor alterations were made during the summer; and in the winter of 1892-3, the total make was found to have increased from an average of about 730,000 cubic feet to about 1,400,000 cubic feet per day. During 1893 the old main flue was reduced in size by about 2 feet in depth and 9 inches in width at two points; one being at the end of the old bench, and the other at the junction with the chimney—the object being to reduce the size of damper used, and to enable the author to have more control over the draught by putting in an extra damper. The results attained have been highly satisfactory; the heats all round being better and more regular during the past winter than they had ever been before.

Two purifiers of the same capacity and similar external design to those already in use, and which had been contracted for in 1892, were connected up in the summer of 1893 (slide-valves being used for working them), and so arranged that either or both could be worked at will.

Another exhauster of 80,000 cubic feet capacity was also laid down (the original reciprocating one being removed to Heaton Lane); the inlet-main being enlarged to 30 inches, with branches for two more exhausters, when needed for the next section. The outlet from the purifiers was also taken out, and relaid at a different level, to suit future work, and also to do away with several syphons which were found to need much attention—in fact, the whole of the mains from the retort-house to the meter have had to be altered for this reason, and to enable the new plant to be suitably connected.

The whole of the plant having been in use during the winter of 1891-2, it was determined to proceed with a further extension at the western end of the old retort-house.

The design was made somewhat elaborate, in consequence of the building being contingent to the cattle market, and in full view of the town. In the main body of the brickwork, ordinary bricks are used; but the arches and pilasters are picked out in terra-cotta and blue Staffordshire bricks.

The design of the old building was only departed from by the introduction of a roadway through the retort-house. There are two of the smoke-shafts only on this end; one of them being new, and the other having been removed from the eastern end of the old building for the sake of uniformity. There are now six of these in the entire length of 345 feet. There are eight beds, 9 ft. 4 in. wide, each containing eight 23-inch by 17-inch ⌂ retorts, set on the regenerative principle; the furnaces being in a basement, the floor-level of which is 8 ft. 6 in. below the ground-line. The 4½-brick foundation walls, reduced to 4 bricks at top, have a batter of 4½ inches, and contain three openings, 6 ft. 6 in. wide on each side. These were put in for the purpose of inclined roadways whenever they were needed. At present, only one has been required. The floor has been all formed of about 4 inches of concrete smoothed on the top, and skimmed over in cement, with the exception of the portion immediately in front of the furnaces, which has been paved with brick on edge up to the 9-inch columns supporting the floor. The charging-floor to within 6 feet of the retort-bench is formed of cast-iron plates carried by 14-inch by 6-inch by 6-inch joists, resting on columns 10 ft. 10 in. centres; the remaining portion being formed of 4½-inch jack arches, 3 ft. 7 in. span, 4 inches rise, levelled up with fine concrete, and afterwards paved with brick on edge.

The end of the retort-house is built close up to the boundary wall, and is on a considerable bevel. The unequal space thus formed has been utilized by putting in a lavatory for the men. Over this and the roadway a mess-room, reached by a cast-iron staircase, has been arranged. It consists of T and L I framing, covered with corrugated sheets. The floor of this and the lavatory is built of 1¾-inch by 1¾-inch by 4-inch steel joists, placed 2 feet apart, and resting at each end on the main girders; the space between being filled with breeze concrete, 10 inches thick, in the proportions of 5 parts breeze to 1 part cement—the top being afterwards skimmed over in cement.

The cart road is formed of jack arches, 9 inches thick, 4 ft. 7 in. span, 4½ inches rise, springing from 14-inch by 6-inch rolled joists, 60 lbs. to the foot; the haunches being filled in with concrete, and finished off with a paving of 4-inch cube Welsh setts, asphalted.

The retorts are all fitted with patent mouthpieces and steel lids; the ascension-pipes are 7 inches internal diameter, reducing to 6 inches at top; the H and dip pipes also being 6 inches. The method of carrying the hydraulic and foul mains is similar to that already described; the attachment of the 9½-inch by 4½-inch rolled joists to the buckstaves being somewhat different, owing to these being of bulb iron instead of flat bars as in the previous work.

With regard to the general arrangement of the retort-bench, there are four buckstaves at each end, formed of 18-inch by 6-inch by 6-inch rolled joists, tied together by 4-inch by ⅝-inch flat bars bolted up in lengths; the latter being connected to the 14-inch by 6-inch joists. The side buckstaves are formed of 10-inch by 6-inch bulb iron, 50 lbs. to the foot, and are connected on the one side to the 14-inch floor joists, and on the other side are let into the brickwork forming the projecting front of the furnace, and are kept in place by the ends of the floor girders which butt against them. The bottoms of all these side buckstaves are protected from the action of water and hot coke by cast-iron shields, which come up to a height of about

2 feet above the floor-level. The hydraulic main, seal-regulating valves, and boxes, with their connections, are similar to those previously described. The roof is similar to the old one in appearance; but all the round bars, jaws, eyes, &c., have been replaced with flat iron and riveted joints.

The whole building is now 345 feet long down the centre; and it is estimated that 2,500,000 cubic feet of gas per diem can be produced in it. From the last portion, which has lately been put to work by itself, a make of 1,100,000 cubic feet has been obtained; the make per mouthpiece being upwards of 8000 cubic feet. It is probable that, by replacing the settings of fives by sevens, and altering the firing throughout to the regenerative principle, 3,000,000 cubic feet of gas per day may be reached. The make per mouthpiece, it may be mentioned, has, on the ordinary beds, averaged during last winter about 7000 cubic feet; and at the Heaton Lane works, about 5200 cubic feet.

The total amount of money spent upon these extensions, including the last gasholder and tank, is £38,905. There are still under consideration various additions and schemes, which have for their object the facilitating of work and the cheapening of the cost of manufacture; so that until these are carried out the works cannot be considered as fully completed.

Mr. J. C. Belton, formerly Manager of the Wellington (Shropshire) Gas-Works, has entered upon his new appointment with the Willenhall Gas Company.

Mr. Joseph Brooks, the Chairman of the Gas Committee of the Manchester Corporation, who has been in ill-health for some time, is, we regret to hear, in so serious a condition as to cause considerable anxiety to his friends.

Reduction in Price by the South Metropolitan Gas Company.—The Directors of the South Metropolitan Gas Company announce that, having now made their coal contracts, they have decided to reduce the price of gas from 2s. 5d. to 2s. 4d. per 1000 cubic feet. This reduction, which represents upwards of £26,000 per annum to the consumers, will take effect from Lady-day last.

The Forthcoming Meeting of the Incorporated Gas Institute.—We are asked by the Secretary of the Incorporated Gas Institute (Mr. F. G. Burfield) to notify that the forthcoming meeting will be held at the Westminster Town Hall on the 19th, 20th, and 21st prox.; and that full particulars of the arrangements in connection therewith will be furnished to the members in due course.

The Annual Meeting of the British Association will be opened at Oxford on the 8th of August, when Dr. J. S. Burdon Sanderson will resign the presidency, and be succeeded by the Marquis of Salisbury. Among the discourses announced for the meeting will be one by Professor J. Shield Nicholson, M.A., on "Historical Progress and Ideal Socialism." The concluding general meeting will take place on the 15th of August.

Mr. Frank Scott, who has been for 13 years Manager of the Kelso Gas Company, has been appointed Assistant-Manager to his father, Mr. Alex. Scott, of the Galashiels Gas Company, with reversion to the post of Manager when it becomes vacant. During Mr. Scott's management at Kelso, the Company have extended their operations, and their prosperity has increased. The appointment is a satisfactory and pleasing one.

Death of Mr. G. Bailey, of Hythe.—We regret to hear of the death of Mr. George Bailey, of Hythe. The deceased, who had attained an advanced age, was one of the pioneers of the Hythe and Sandgate Gas Company, and was a Director of that undertaking; his businesslike habits making him a valuable adviser in connection with the Company's responsibilities. Deceased was formerly a member of the Hythe Town Council, and also occupied other important public positions.

Complimentary Dinner to the Water Engineer of Nottingham.—Last Thursday, the new Water-Engineer of the Nottingham Corporation (Mr. D. M. F. Gaskin) was entertained at dinner by a numerous company, including members of the Water Committee and representatives of the various branches of the department. The toast of the evening was proposed by Alderman Jelley, Vice-Chairman of the Water Committee, who presided in the absence of the Chairman (Alderman Sands). In doing so, he expressed the confidence the Committee had in Mr. Gaskin, and said he hoped those who served under him would work amicably together, so as to make the new appointment both agreeable to them and beneficial to the town. Mr. Gaskin, in responding, said he appreciated deeply the honour done him by those present in inviting him to meet them. He assured them that he should put forth his very best abilities in the service of the Corporation; and he trusted to have the co-operation of all who were under him. The more they worked in harmony, the more united they would become, and the better they would serve the town.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 924.)

During the past week, business on the Stock Exchange gradually dwindled down to very meagre proportions. It being settlement week, with the prospect of the Whitsuntide recess to follow, little fresh business was entered into; and after the settlement was over, many members took their leave until to-day. The general prospect of affairs was not such as to induce a disposition to enter into fresh commitments; several incidents abroad arousing some degree of anxiety, and playing into the hands of the "bears." The financial position of India, with exchange at the lowest point on record, and (it is to be feared) still falling, coupled with the reports of military disaffection, is a sufficiently serious matter. The same perplexing question of exchange is also agitating more than one State in South America; and the recovery in Argentine securities is arrested. Naturally much depression was produced in the markets here. Gilt-edged investments fully held their own; and rails and some other commercial and industrial enterprises at home were firm. Money found employment, owing to Stock Exchange requirements; but the market is now settling down to a condition of apparently assured ease. The Gas Market was fairly active in the earlier portion of the week; but, in common with the rest, it slackened down considerably before the close. The general position is one of great strength; and several of the more important issues have risen in value. Gaslight "A" is the only exception, opening at a slight reduction, and ruling at about the same figures for moderate business until the close. More was done in the debenture and preference stocks, which were steady and unchanged. South Metropolitans were strong and pretty active; and the "C" stock rose 2. The feature of the week was the announcement of a penny reduction in the price of gas, the wisdom of which step was much canvassed. Very little was done in Commercials; but what stock changed hands realized a higher figure. Suburbans and Provincials were quiet, but very strong, though Brentford new was the only one to advance. All the Continentals were in favour—Union especially; and Imperial made a good recovery from its recent fall. None of the rest offered any noteworthy feature. Water Companies generally were very firm; and most quotations have improved.

The daily operations were: The Gas Market was fairly active on Monday; and prices all round were good. Brentford new rose 2; and Continental Unions, 1 each; but Gaslight "A" fell 1. On Tuesday, equal activity ruled; and prices were well maintained. On Wednesday, the market began to grow quieter; but the tendency of values was still upward. Commercial old and South Metropolitan "C" advanced 2 each; and Imperial Continental, 1½. Thursday was quiet; and Gas was unchanged. But in Water, Lambeth rose 2; and West Middlesex, 1. The position remained similar on Friday. Kent and New River advanced 2 each. Business was good on Saturday; and Continental Union and Imperial Continental improved 1 each. In Water, East London and Lambeth rose 3 each.

ELECTRIC LIGHTING MEMORANDA.

The Competition between Gas and Electric Lighting—The Condition of the Incandescent Electric Lamp Trade—Further Information respecting the Electrolysis of Pipes.

Mention is made elsewhere of the ingenious attempts that were made last week by certain technical journals to argue that the gas lighting industry is going down, and that of electric lighting going up, upon the bare premiss of the recent fluctuations in the rate of expansion of the Metropolitan Gas Companies. How hollow the argument is may be understood from the one circumstance that the whole extent of the lighting connection of all the central station electricity supply companies in London, stated upon the most favourable bases of computation, hardly exceeds the normal annual increase of the Gas Companies. Nor does this statement apply to London alone; for not in any town of the civilized world has the introduction of electric lighting served to keep the local gas undertaking at a standstill. "Yes, this may be so," say the partizans of electric lighting; "but the effect is only transient. The popularity of electric lamps has increased the demand for light of every kind; but as soon as the electricians are in a position to supply as much light as the public require, the demand for other kinds of light will fall off." The argument is specious; but it loses sight of the controlling element of the supposed competition, which is the cost. It is the fact that, speaking broadly, the capacity of the community for absorbing any given commodity—be it a method of lighting houses and streets, or a beverage—depends upon its price more than upon any other consideration. The cheaper the article, the greater the number of possible consumers. Conversely, the wealthier the community, the choicer are the commodities it demands. Electric lighting when not home-made, is at least three times the price of gas lighting, and what this means in

the estimation of the public may be illustrated by reference to any other commodities of interchangeable application, and bearing the same ratio of value to each other. Take the example of wine. How does the consumption of *vin ordinaire* at 18s. per dozen compare with that of a choice vintage selling at 54s. per dozen? Where would be the sense in arguing that because the consumption of the former happened to show a check for a particular year, while that of the latter exhibited an increase, therefore the latter was on the highway to supersede the former? It cannot be done. As compared with electric light, gas is the general servant of the people; and the world will have to turn round a good many times before expensive goods drive cheap, serviceable ones out of the market.

The history of the incandescent lamp trade affords an instructive lesson in the methods of modern business, which is all the easier to grasp for being condensed into a brief period of time, and confined to traffic in a speciality. To begin with, several people hit upon the idea about the same time; and as soon as the first crude essays in production saw the light, there was a great rush of improvers whose share in the development of the merchantable article was hardly second to that of the true and first inventors. Then as soon as there was found to be "money in it," the electric incandescent lamp patent was fought over as dogs fight for a bone. Eventually, one of the patentees succeeded in establishing his right; and thereafter for some years all the other claimants had to keep away from this particular preserve, while the proprietors recouped themselves for their legal and other exploitation expenses, and made the best of the monopoly. Then the patent right lapsed, and competition set in so furiously that, as an electrical contemporary declares, "within less than six weeks of the lapse of the Edison patent, foreign incandescent lamps were sold in London for 7d. apiece." This cut-throat trade rivalry could have but one issue. The article thus pushed in the market became deteriorated to the point of worthlessness; and the whole trade was threatened with demoralization and ruin. The result has now been to bring to their senses the foreign makers of incandescent lamps, while it is just not too late; and it is reported that steps are being taken to syndicate the largest Continental manufacturers, with a view to putting a stop to the suicidal cutting down of prices. There is stated to be no intention on the part of the firms composing the Union to attempt the restoration of prices to anything like the old standard. It is believed that the price will still be something less than 1s. for lamps of the ordinary trade sizes and descriptions; and at this rate it will be possible for the manufacturers to make fair profits and produce a good article. The next thing to watch will be the manner in which the proposed Syndicate maintains itself against the incessant temptations to break away, which generally ruin all combinations of the kind.

An interesting paper on "The Destructive Effect of Electrical Currents upon Subterranean Metal Pipes" was read by Mr. J. H. Farnham before the American Institute of Electrical Engineers, and has been reproduced in the *Electrician* for the 4th inst. Mr. Farnham practises in Boston (Mass.); and he describes, with remarkable perspicacity, the way in which he became professionally concerned with this troublesome effect of electrical distribution. The most striking feature of his disclosures is the apparent triviality of the cause that produced widespread mischief to cables and gas and water pipes. The difference of potential between cable and earth was only from 1·5 to 2 volts; and it was only where the cable was positive to the earth that electrolysis of neighbouring pipes went on. Mr. Farnham obtained some renown by his success in hunting down the mischief to its source. His paper was illustrated by photographs of some corroded gas-pipes which showed a liability to perforation near the joints, while there were others in which no such selective action was apparent, the whole of the pipe being destroyed. It is remarked by the *Electrician* that, thanks to the Board of Trade regulations recently promulgated, we are not likely to witness in England anything like these results, though it is admitted that something of the kind might have happened had there been an electric traction "boom" in this country, and no authority empowered to insist on the negative pole being put to earth, and the water-mains being effectively connected with it. Nevertheless, Mr. Farnham holds that something more than the requirements of the Board of Trade Memorandum is necessary to prevent the possibility of electrolysis, seeing that a fractional difference of potential between cable and pipe will bring it about. He holds indeed a decidedly pessimistic view upon the whole subject; and he concludes his paper by declaring that, while precautions after the Board of Trade model are advisable, and indeed indispensable, if pipes are to remain sound in the ground near an electrical tramway, yet "eternal vigilance" is the price of sound pipes under such conditions. The statement is not a very comforting one for owners of gas and water pipes; but there is the satisfaction for the present that meanwhile electrical traction plants are not common in England, and when they come we shall be prepared for them.

Incandescent Gas Lighting at the Opera House.—The Incandescent Gas-Light Company, Limited, have completed a large installation of their lights at the Covent Garden Theatre, which opened last night for the Italian opera season, under the management of Sir Augustus Harris.

COMMUNICATED ARTICLE.

THE "LANCET" COMMISSION REPORT ON GAS-FIRES.

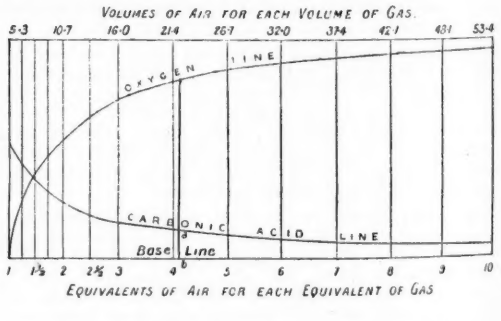
By Chas. W. Folkard, Associate of the Royal School of Mines.

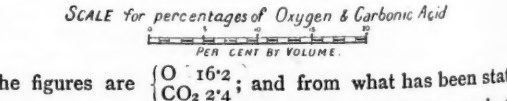
While fully admitting that great credit is due to the *Lancet*, for its enterprise in conducting a difficult and laborious series of analyses, it cannot but be a matter of regret that the experiments were carried out with so little forethought in regard to details, and published without any attempt being made to check the accuracy of the results by independent means. As a matter of fact, these results are in some cases obviously self-contradictory, as will be shown later on; and in many instances they are quite worthless for the delicate purpose of comparing the pattern of one maker with that of another, as regards economy of gas used. But, on the other hand, looked at broadly they are undoubtedly of great value, and should be the means of conducing to a general levelling up as regards excellence of performance of the stoves of various makers.

Fortunately for the cause of truth, the checking of an analysis of the products of combustion of coal gas is a very simple matter (far easier than the accurate performance of the analysis itself), because, when the combustion is complete, we have a mixture of gases of known composition combining in a known way with one of the constituents of another mixture of known composition. It is somewhat as if we had two boxes, one containing a hundred apples and the other a hundred oranges, and instructed an assistant to interchange the contents—always subject to the stipulation that for each apple (or orange) taken out one, and only one, orange (or apple) from the other box should be substituted. Under such circumstances, it requires no great mathematical knowledge to see that the number of exchanges which have been made can be ascertained by counting the number of apples or of oranges in either box; if we count both, we have a double check; while by examining the contents of each box separately, we have a fourfold check on the accuracy of the operator who made the exchanges—*i.e.*, as to whether he rigidly adhered to the stipulation above alluded to, and was careful to avoid all loss of fruit.

This, of course, is only a rough illustration; and to apply the principle to results of analyses of the products of combustion of coal gas in air, we have simply to remember that (1) air contains 208 volumes of oxygen gas and 792 volumes of nitrogen gas in every 1000 volumes; and (2) that Nature is the assistant who takes charge of the interchanges, and may be relied upon never to make a mistake in chemical matters. Now if we burn such an amount of coal gas in a given bulk of atmospheric air as is sufficient to convert half the oxygen present into carbonic acid, &c., it is evident that the other half of the oxygen will be found in the products of combustion. Consequently, we can ascertain the quantity of coal gas burnt, either by the carbonic acid produced or by the amount of oxygen which remains in the products. If the results of these two methods agree, it is a strong confirmation of the accuracy of both; but if they disagree widely, it is evident that an error has crept in somewhere. To avoid tedious calculations, we may use a diagram with two curved lines—the one representing the percentage by volume of oxygen, the other of carbonic acid. If everything is correct, the percentages of these gases in the products of combustion will be represented by the heights of their respective curves above the base-line; a fair allowance being made for unavoidable errors of experiment, which may be taken at about ¼ and ½ per cent. for the carbonic acid and oxygen respectively.

An example will make everything clear; and for this purpose we will take the results given on page 6 of the reprint of the third report of the *Lancet*, in column 8 for Stove A.





The figures are $\begin{cases} O & 16{\cdot}2 \\ CO_2 & 2{\cdot}4 \end{cases}$; and from what has been stated above, we shall expect to find these two percentages in the same perpendicular line somewhere in the diagram. With a pair of compasses or dividers, measure off 16·2 divisions on the scale of percentages, put one leg on the base-line, and move the compasses bodily to the right or left till you find the position at which the other leg touches the curve for oxygen; taking care that the one leg is exactly underneath the other, or, in other words, that the line joining the extremities of the two legs

is at right angles to the base-line. Draw this line with a pencil, so as to cut the carbonic acid curve in the point A (see diagram); then close the compasses, so as to be equal to the distance A B, and put one leg at the zero of the scale of percentages. The position of the other leg will then give the theoretical percentage of carbonic acid corresponding to a residue of 16·2 per cent. of oxygen—viz., 2·5 per cent., against 2·4 per cent. found, which is, of course, perfectly satisfactory.

It will not be necessary to go through the other results. Anyone interested in the matter can do so. It should, however, be noted that, where the curves rise or fall rapidly—*i.e.*, in our present case where the number of equivalents of air to each equivalent of coal gas is small—graphic methods of calculation do not give very accurate results; it being obvious that very slight movements to the right or left make a great difference in the height of the curves above the base-line. In such cases, the results should be calculated in the ordinary way. It will be sufficient to remark that in several instances the discrepancies are far greater than can be accounted for by allowable errors of experiment; while on page 7 of the reprint, in the tests of the A and B stoves (column 8), the oxygen left in the case of B is 2 per cent. less than in that of A, whereas it should be slightly greater, obviously less of it being required to form 0·9 per cent. of carbonic acid (B) than for 1·09 per cent. (A).

In these remarks, it is assumed that there are no misprints, which in the case of a reprint may fairly be taken for granted. Under these circumstances, the assertion previously made seems to be justified—viz., that the results are not sufficiently accurate to be used for a comparison of the merits of stoves of similar construction by different makers, the performances of which, as regards economy of gas, would probably differ by only 5 or 10 per cent. The fact is that the accurate analysis of a gaseous mixture is a delicate and difficult operation; and even after long practice, the analyst is liable to lose his labour at any time, by leakages and other unsuspected causes of error. This will not be a matter for surprise, when it is remembered that everything depends on the soundness of a ground-glass joint one-sixteenth, or at most one-eighth, of an inch wide on the plug of a glass stopcock, which must be opened and shut twice for each constituent to be determined; and that there is frequently a difference of pressure of 5 or 10 lbs. per square inch on the two sides of the stopcock. This, of course, refers to analyses over mercury, in Frankland's and Ward's or similar apparatus.

We now come to the consideration of the results as a whole, when looked at broadly, and subjected to mental analysis; experimental errors in the details being disregarded. One point of great importance is brought into prominence by the *Lancet* Commissioner's figures when thus analyzed—viz., that the number of equivalents of air used to each equivalent of coal gas varies enormously in the stoves of different makers. This fact influences, or should influence, the performance of a stove in two ways: (1) As regards the ventilation of the apartment—a most important matter, in the sick-room especially; (2) as regards economy in gas used for a given heating effect.

(1) It is obvious that a simple and efficient means of rapidly changing the air of a room is most desirable, especially at certain times. The old methods of burning tobacco, lavender, cedar dust, &c., simply mask the noxious effluvia; whereas they should be removed as quickly as possible, and replaced by fresh air, pure and simple. Nothing can equal a gas-fire for certainty and simplicity in this respect; the only desideratum being a simple means of controlling the amount of air set in motion, and this not only to avoid any unnecessary draught (after the air of the room has been completely renewed), but also (2) for economy of gas. The total heat developed by complete combustion is exactly the same when 10 equivalents or when only 1 equivalent of air passes through the stove; but in the former case the temperature of the products of combustion is enormously reduced, on account of the heat being distributed over nearly ten times as much material. It is evidently a far easier matter to cool 1 cubic foot of white hot gases (and in doing so, of course, to warm the room), than to cool 10 cubic feet of red hot gases; and, as practically all the heat contained in the products of combustion as they enter the flue-pipe of the stove is lost so far as regards the warming of the room, it is a matter of the greatest importance to reduce the *excess* of air to the smallest possible quantity. The *Lancet* Commissioner's results show the great differences which exist in this respect amongst the various makes of gas-fires, a point which apparently has not been previously noticed, and which opens a new field of improvement to makers of these appliances.

It is possible that a gas-fire completely closed in front by a moveable window "glazed" with rock salt (which material, as is well known, offers practically no obstruction to the passage of radiant heat), would show a very considerable economy of gas used for a given heating effect, as compared with others drawing in large quantities of air through an open front. This, however, is merely a suggestion, and might, of course, be found worse than useless in practice. A glance at pages 6 and 7 of the *Lancet* reprint would seem to indicate that the iron-trellis and asbestos-fibre fires work with far less excess of air as a rule than the clay-ball patterns; this being probably due to some obvious difference of construction.

Now, if the above conclusion as to the increased economy possible when dealing with a small rather than a large bulk of hot gases be true (and no one with a practical acquaintance of steam-boiler working will be hardy enough to doubt it), how is it that in four cases on pages 6 and 7 of the reprint—namely, Gas-Fires I, M, N, and P—the cost of gas per degree of rise of the thermometer is from 10 to 80 per cent. more at minimum than at maximum consumption? The results of the analyses of the products of combustion furnish the reason—viz., that the excess of air is far greater at minimum than at maximum working, which is another evidence of the great desirability of being able for economy of heating effect to control the air supply; the gain of efficiency from having less heat to abstract by means of a given surface being far more than counterbalanced by the general lowering of the temperature due to increased excess of air. It would appear, from the results obtained by using the diagram, that, in many cases at all events, the *absolute* amount of air passing through a stove was about the same at minimum as at maximum working.

Now these general results deduced from the Commissioner's analyses are distinctly valuable; and in view of the importance of the subject, it is to be hoped that a fresh series of experiments will be instituted at no distant date to clear up the doubtful points which have been alluded to. Under these circumstances, it may not be superfluous to offer one or two suggestions as to the details of the arrangements for making a fair comparison of the merits of different makes of gas-fire:—

1. That the thermometers used should be capable of indicating 0·1° Fahr.

2. That the position of the thermometers used should be distinctly stated after such proper positions have been determined. On this latter point, the writer confesses that, after several trials, he has no definite ideas whatsoever; and yet it is evidently a matter of the highest importance for obtaining fair and accurate results.

3. That the room in which the comparisons are made should be more like the average of those in which the gas-fires will be actually used by the public. On this point, which is also a very important one, the description on page 2 of the reprint (second column, last paragraph) is not very clear. It is stated that "the room being situated at the top of the building, so that the roof and two walls were exposed to the outside, there was no appreciable difference between the external and internal temperature." In some experiments made in January and February, 1892, on the heating effect of an oil-stove without a flue to the open air, used in a lean-to greenhouse of about 680 cubic feet capacity, the writer obtained very discordant results; and it was found that the one-sixteenth of an inch thickness of sheet glass, which formed the roof and three sides, caused a difference between the internal and external temperature of from 0·5° to 8° Fahr. on different days, the stove being unlighted. The former of the two figures was noted during a rapid thaw, and 8°, 7·5°, 8°, 6°, 5·5°, difference were observed on other days. It was suggested that the presence or absence of clouds was probably the cause of the variation in the differences between the internal and external temperatures, which led to the meteorological conditions being noted. The following extract from the note-book will show the probability of this being the explanation.

2/2/92.—4 p.m., clear sky: Stove unlighted, doors and lights shut. Temperatures, 42° and 34½° = 7½° difference.
Later in the evening: Two flames lighted; starlight; temperatures, 43½° and 34° = 9½° difference.
Later: Starlight; temperatures, 44° and 34° = 10° difference.

Deducting 7½° due to the glass roof, we have 1° and 1¼° Fahr. rise of temperature by each flame from a one-inch wick.

19/2/92.—Strong east wind, cloudy: Matting over sides and lower half of roof. Temperatures, 35° and 31° = 4° difference.*

It is obvious that the 1° and 1¼° rises of temperature noted as being produced by a paraffin oil flame from a one-inch wick, are in reality very discordant results, as they vary by 25 per cent.; and in some previous experiments the limits of rise of temperature were 1° and 1½° or 50 per cent. variation, this being before the state of the sky was noted. Hence the necessity for sensitive thermometers, the greatest care being exercised as to their proper position, and a record being kept of the weather. Possibly many other precautions will be found necessary in experiments of sufficient delicacy to detect the differences as regards economy of gas in apparatus of similiar construction by different makers. One would hardly expect to find more than 5 or 10 per cent. difference in the gas consumed for a given heating effect by two gas-fires of good design made by two different firms.

A practical confirmation of the necessity for some such precautions as are indicated in the suggestions just made (numbered 1, 2, and 3), is afforded by the figures given in the *Lancet* reprint, on pages 6 and 7, column 4, Stove P, in which, as all the products of combustion are discharged into the room, the results are less liable to extraneous sources of error than in the case of stoves provided with a flue working into a chimney. From these figures, it appears that Stove P, burning 16 cubic feet per hour, effected a rise in the thermometer of 10° Fahr., or at a cost of 0·058d. per degree Fahr. in one hour. The same stove, consuming 6·2 cubic feet per hour, only caused the thermometer to rise 2° Fahr., corresponding to 0·11d. per

*Gardeners and nurserymen are probably well acquainted with the phenomenon in its bearings on glasshouses, and more especially on "cold frames."

degree Fahr.—*i.e.*, about 80 per cent. more—which is a somewhat greater discrepancy than in the case of the experiments with an oil-stove alluded to above. The explanation is very simple—viz., that the subject is a most difficult one, whatever it may appear to be at first sight; and that every detail must be carefully thought out, if the results are to be made available for discriminating between a "good" and a "fairly good" gas-fire.

One other point remains to be noticed—the Commissioner's experiments on the coal-fire. The amount of coal burnt per hour is about the same as in an ordinary open grate; but judging from the analysis of the products of combustion given on page 6 (column 8) of the reprint, the coal-fire cannot be taken as a fair type of the ordinary domestic fire. In the first place, only one analysis is given (apparently soon after fresh coal had been put on); whereas it is self-evident that, to obtain a fair comparison of the performance of a coal-fire (which is always changing its character), as against that of the never-varying gas-fire, *at least* three or four determinations should have been made at different intervals after firing up; the general average of these being used for purposes of comparison.

As we are no longer dealing with coal gas of known composition, burning in atmospheric air also of known composition, it is not possible to accurately check the coal-fire results; but at the same time we may be guided by general principles in our endeavour to do so. In the first place, the entire absence of oxygen is, to say the least, very remarkable. Even in Cornish or Lancashire steam-boilers, which work with a nearly closed fire-door, and where consequently nearly the whole of the air supply has to pass through the bars, we find that about double the theoretical quantity of air has been used; and, as a consequence, that about half the original quantity of oxygen remains in the products of combustion. In locomotives, the excess of air seems to be greater still—viz., about three times that required by theory; and open fires are generally credited with carrying up 5 or 10 times as much air as is necessary for complete combustion, thus effecting a most powerful ventilation of the room.

In the absence of further information on the subject, it is impossible to speak definitely; but common experience shows that a strong current of air is always passing from the room above the fire into the chimney, where it mixes with the gases rising from the fire *without the production of flame*. In other words, the oxygen of this current is not burnt (the temperature at the zone of mixture being, of course, far below that of ignition); and therefore oxygen in large quantity *should* be found in the products of combustion of every open fire. It is difficult to conceive how any ordinary coal-fire could furnish products of combustion devoid of oxygen, even if furnished with a blower, the presence of which latter contrivance would obviously be inadmissible in comparative experiments on heating effects. Assuming that the analysis is correct, it would appear that the coal-fire grate and chimney were of special construction, or were worked under special conditions.

Although it has been necessary to point out some manifest errors which have crept into the *Lancet* Commissioner's results, it is at the same time evident that makers (and eventually users) of gas-fires should derive considerable advantages from the publication of this laborious series of researches.

TECHNICAL RECORD.

THE MANUFACTURE OF CARBURETTED WATER GAS.

In our editorial columns last week, we referred at some length to a statement supplied to us by Messrs. Humphreys and Glasgow relative to their experience in the introduction of plant for the manufacture of carburetted water gas. These gentlemen, it may be remembered, were both connected with the United Gas Improvement Company of America, who have established probably the largest number of water gas and mixed coal and water gas works in the world; and consequently their experience in the erection of this kind of plant has been extensive. Some time ago, they commenced business in London; Mr. Glasgow undertaking the personal supervision of it. He is now about to be joined by his partner, who, as already mentioned, has severed his active connection with the above-named Company (of which he was General Superintendent and Chief Manager), in order to devote his entire attention to the development of the newer enterprise. The experience these gentlemen have gained in the constant design and improvement of apparatus, and in the removal of defects met with in the regular operation of the works of the Company, comprising all the prominent types of water-gas processes, has afforded them exceptionally favourable opportunities for the production of an apparatus combining in itself the most advantageous qualities of the numerous plants which have been under their control. This apparatus has, during the past three years, been carefully and thoroughly adapted to English requirements; and it is submitted with the fullest confidence to the notice of gas engineers in this country. Having said thus much by way of introduction, we will now turn to the statements they have forwarded.

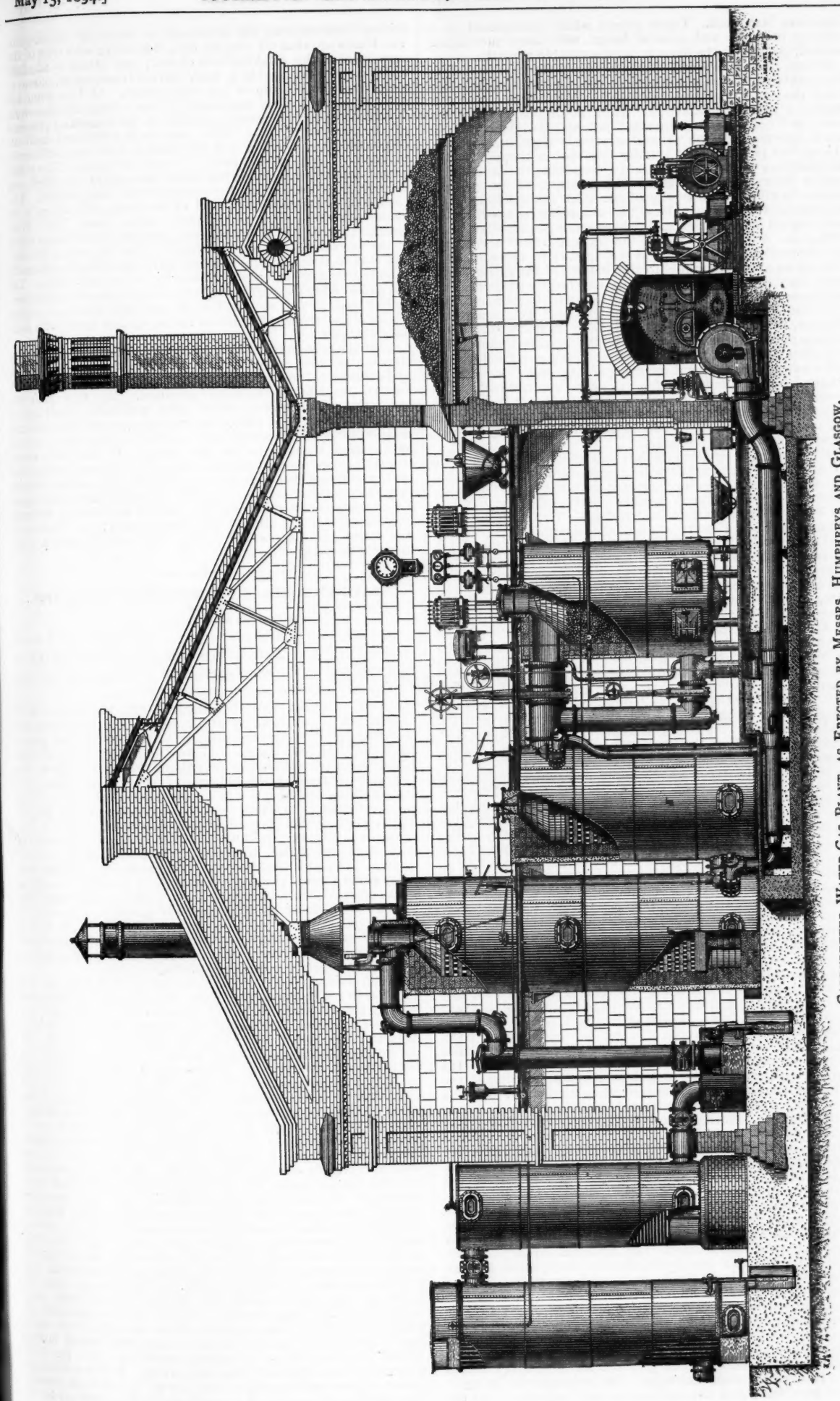
Messrs. Humphreys and Glasgow begin by pointing out that the manufacture of carburetted water gas is an industry of such recent development that very few persons realize the enormous extent of its growth. It has been stated that "two-thirds of all the illuminating gas made in the United States and Canada are the product of this system;" and that, "even in the very centres of the American gas coal regions, water-gas plant is universally operated as an auxiliary to coal gas." It may, perhaps, be objected that, while such a result demonstrates the advantages of carburetted water gas manufacture under the conditions prevailing in America, the higher price of oil in Europe places the system here on a different basis. This, to a great extent, is true; and the point must receive full recognition. At the same time, it should be borne in mind that the overland carriage from the oil-wells to a large portion of American territory is more expensive and far more liable to interruption than transport from the same points to Europe; and that consequently American oil can be, and is, purchased in European ports at prices considerably lower than those which obtain (say) west of the Rocky Mountains. In San Francisco, for instance, the bulk of gas distributed is made from oil costing 4½d. a gallon; while the same quality and quantity of oil can be delivered in any part of the United Kingdom for 2½d. per gallon. Moreover, Europe enjoys the advantage of having two great competitive sources of supply, from either of which oils admirably suited to gas manufacture are obtainable in unlimited quantities.

However widely the American and European conditions may vary in the cost of supplies, it is evident that with 350 towns equipped with water-gas plant, and forced by keen electric lighting competition to distribute a clean gas of high illuminating value, the apparatus for the purpose must be in a thoroughly reliable and efficient state. There must be nothing experimental about the plant or its working. American practice, corroborated by already large European experience, has established absolutely the quantities of material and labour required in water-gas manufacture under given conditions. If, therefore, the price of materials be known, the question of the expediency of adopting water gas becomes a local comparison between the cost of production thus established and other methods of enrichment or manufacture. In this comparison, however, due weight must be given to the following important features peculiar to water gas manufacture: In the first place, there is the smallness of the ground space required; secondly, the rapidity with which the apparatus can be brought into operation and worked to its full capacity; thirdly, the facility with which the plant may be thrown out of use, without loss of gas, and kept idle for a number of hours; fourthly, the possibility of instantly changing the illuminating power, and the practical freedom of the gas from residual sulphur. Other notable features are that, by displacing an equivalent in coal gas, as well as by consuming a proportion of the coke produced, water gas will modify the output of that residual, and enhance its selling price; and the same remark applies, to a certain extent, to tar. Then there is the saving effected in the first cost of plant, and also the independence which it affords in the event of crises in the coal trade; for so long as enough coal can be had to yield the coke necessary for the plant, the latter can be kept at work. Lastly, and not of the least importance, is the practical independence of labour which results from the adoption of the plant.

While the foregoing considerations must materially influence a purely financial comparison, the following statement of the average cost of carburetted water gas sets forth in detail the actual quantities of material and labour required per 1000 cubic feet of 24-candle gas, together with all other chargeable expenses:—

Oil, 3⅜ gallons, at 2¾d.	10·1d.
Coke (including boiler fuel), 45 lbs., at 12s. per ton	2·9
Labour, total employed	1·5
Purification materials	0·5
Repairs and maintenance	1·3
Water (if not re-circulated)	0·2
Superintendence	0·5
Total cost per 1000 cubic feet	17·0d.
Cost per pound of sperm	0·207d.

In the foregoing estimate, no credit has been taken for the oil tar recovered. This residual usually exceeds half a gallon per 1000 cubic feet—its value depending upon the quality of the oil used; and if no more advantageous disposition can be made, its combustion under the boiler will reduce the fuel account by from 5 to 8 lbs., as well as ease the labour of firing. The figures here given cover the entire cost of the gas in the holders, when made in quantities approximating half a million cubic feet per diem, with a probable margin of safety of at least 1d. per 1000 cubic feet. Comparing them with the cost of manufacturing coal gas in London and its vicinity, Messrs. Humphreys and Glasgow point out that in 1890 it was 16·53d., in 1891 it was 17·68d., and in 1892 it was 17·54d. per 1000 cubic feet of 16-candle gas for the London Companies; and 17·07d., 19·91d., and 20·51d. for the Suburban Companies. In this connection, it may be mentioned that, while the average cost of the pound of sperm equivalent produced by the London Companies for the above-named years was 0·305d., the cost in the case of The Gaslight and Coke Company in the past year's manufacture of carburetted water gas, with plants of 12 million cubic feet daily capacity, was only about 0·210d., according to the statement made by Mr. A. M. Paddon in the course of the paper prepared by him for the Incorporated Institution of Gas



CARBURETTED WATER-GAS PLANT, AS ERECTED BY MESSRS. HUMPHREYS AND GLASGOW.

Engineers last week. These plants, while constructed on a common principle and general design with those now being erected, are inferior to them in certain notable respects.

Messrs. Humphreys and Glasgow devote the next portion of their statement to a discussion of the theory of carburetted water gas; and they then proceed to describe the apparatus employed in its manufacture. They point out that by the Lowe, or "generator-superheater," process, the production of gas is intermittent; the "runs," or periods of gas making, and "blows," or periods of air blasting (in order to recuperate the temperatures within the apparatus) succeeding each other at regular intervals. The distinguishing feature of the process consists in utilizing the energy of the blast gases issuing from the generator during the "blow" for subsequently gasifying the enriching oil in the presence of the hot water gas simultaneously produced. A feature of note in the process is the "reversing" or "alternative" method of gas production in the generator. If steam be always admitted to the bottom of the fuel-bed, the heavy duty of its decomposition is too largely performed by the power portion of the fire, which becomes, in time, inactive, and deadened beyond the point of ignition. The succeeding air-blast, therefore, instead of rekindling it, chills this lower stratum almost to the temperature of the outside atmosphere; and when steam is again admitted, it condenses freely in the cold cinder. The frequent removing of this condensing stratum is both laborious and wasteful. A periodical reversal of the current of steam in the generator corrects this evil, by distributing the duty of the fuel-bed throughout its entire bulk. As this reversal is effected in one movement, possibility of confusion or mistake is precluded.

The following description will be rendered clearer by reference to the illustration on the proceeding page, showing the apparatus in its usual sequence—viz., generator, carburetter, superheater, oil-heater, washer or seal, scrubber, and condenser (the last two being situated outside the building). The generator, carburetter, and superheater are cylindrical steel shells, thickly lined with special fire-blocks, between which and the metal are annular spaces packed with non-conducting material. The generator is usually supported on short columns, as shown; leaving cartage room under the hopper-shaped ash-pit. The grate, controlled by the several cleaning-doors, is located slightly above the ash-pit; and the fire is charged with coke through the door in the extreme top. The generator is connected, both above and below the fuel-bed, with the top of the carburetter, the bottom of which leads laterally into the adjoining superheater. The carburetter and superheater, which are usually referred to as the "fixing chambers," are filled with checker-work, designed and spaced as determined by long experience, and affording such an enormous heating surface that even the heaviest distillates can be permanently gasified at the low temperatures necessary to the highest illuminating effect. The enriching oil is introduced at the top of the carburetter. At the top of the superheater is a valve-controlled outlet for the blast products. During the "run" this outlet is closed, and the carburretted gas escapes through the side take-off pipe into the small vertical casing of the oil-heater; and thence, forcing the seal in the washer, through the scrubber and condenser to the relief holder. The oil-heater is a simple and practical arrangement for pre-heating the oil, on its way to the carburetter, by means of the hot gas escaping from the superheater. A steam-pump connected with the storeage-tanks delivers oil at a constant and moderate pressure, through a meter and the heater above described, to a centrifugal distributor in the top of the carburetter—a special appliance which ensures the even and effective introduction of the oil to the hot water gas. The single pump supplies any number of carburetters. An elevated operating-floor, flush with the generator charging-door, affords the best means of manipulating the plant; and consequently all levers, valves, and appurtenances requiring attention, are assembled at this level. It is here, by his clock, that the gas maker stands. The air-ducts, situated below the ground floor, and leading from the blower to the generator, carburetter, and superheater respectively, are controlled by valves regulated from the operating-floor. It will be noticed that the superheater considerably exceeds the other vessels in height. Besides giving greater fixing capacity, this disposition creates a strong natural draught from the generator; so that, when charging or cleaning, no inconvenience results to the men from the furnace gases. The shells being thickly lined with non-conducting material, radiation is reduced to a minimum. The entire plant has been developed with special attention to convenience and simplicity in operation.

Having described the apparatus, Messrs. Humphreys and Glasgow proceed to explain the method of working it. A fire is started in the generator, which is then deeply charged with coke and opened to the blast. The air enters in large volume below the grate, and quickly kindles the fuel; while the hot products resulting from the partial combustion pass forward through the carburetter and superheater, and, after parting with their sensible heat, escape into the stack. As soon as these generator gases have sufficiently warmed the checker-work, supplies of secondary air are admitted to the top of the carburetter and the bottom of the superheater respectively; and the combustion is regulated to give the requisite temperatures in the two vessels simultaneously. The generator fire being in proper condition, and the carburetter and superheater at the desired temperatures, the apparatus is ready for making gas. The blasts are shut off one by one, beginning with that of the superheater; the stack-valve is closed; and steam is admitted under or over the fuel-bed, and, having traversed it, passes as water gas into the top of the carburetter. At this point the oil is introduced, and, encountering the heated checker-work, is vaporized, and ultimately gasified, in the beneficial presence of the hot water gas. This process is continued until the temperatures of the fire and the checker-work are sufficiently reduced. The oil is then shut off; next the steam. The stack-valve then being opened, the blasts are again admitted, and the energy of the fire and the checker-work recuperated. The generator is supplied with fuel at intervals of from 45 to 60 minutes, and cleaned usually once during each shift. With intermissions of firing and cleaning, the process consists solely of the operations described, alternating at regular intervals; and it is so simple in practice that its routine may be efficiently acquired by any ordinary workman in two or three days. The gas passes from the seal through the scrubbers and condensers, and is subsequently deprived of its carbonic acid, and treated for its slight sulphur impurities in the manner usual with ordinary coal gas.

Although it is quite possible to make water gas direct into the storeage holders, without the intervention of a relief holder and exhauster, the advantages of the relief holder system have secured its almost universal adoption. By this plan the generating plant works, under light pressure, direct into a crude gasholder, from which the exhauster draws at a constant rate—ensuring the most efficient results in purification, as well as accurate registration by the meter. In this way exact, or even close, correspondence between the generating and purifying departments is no longer necessary; either branch being independent of the other for a period depending upon the capacity of the relief holder. One of the smaller storeage holders is generally utilized for this purpose; and where coal and water gas are purified jointly, the use of such a relief holder is necessary.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Discussion on Mr. Lees's Paper.

Last week we published the paper read by Mr. H. Lees, of Hexham, on "Gas Undertakings in Relation to the Use of Gas-Engines," before the above-named Association, on the 5th inst. To-day we give the discussion upon the paper.

Mr. W. Hardie, jun. (Tynemouth), said the subject dealt with by Mr. Lees was of great interest to the members; and they must all have listened with great pleasure to the paper, more particularly to the part where the author made a comparison between the cost of the gas and the steam engine. He (Mr. Hardie) rose for the purpose of asking a question. Mr. Lees said the cost of gas was 11d. per 1000 cubic feet. This seemed to him to be a very good figure; and he would be glad if Mr. Lees would give them the details by which it was arrived at. Mr. Lees said it was not so much in large works as in small ones that the gas-engine would be found particularly useful. This, he thought, was certainly correct. He had seen many small gas-works using as much as 12 tons of coke for a steam-engine. He thought this was a mistake; and when they went up to anything approaching that quantity, they ought to have a gas-engine. He also agreed with Mr. Lees that it would be preferable to have a gas-engine, and a small steam-boiler to use for other purposes, such as keeping the holders right in winter and steaming out the scrubbers.

Mr. T. Bower (West Hartlepool) said he had been for the past few years endeavouring to do what he could in his small way in the Hartlepools, in the introduction of as much gas power as possible. But before he referred to what had been done at Hartlepool, he would like to mention that in 1879 he put down at Lytham a 3½-horse power gas-engine to work the exhauster and some pumps. That engine had been continuously running; and it was working that day. He saw it about two years ago; and, with the exception of an occasional packing of the joints and ordinary repairs which could be done by a stoker, and one instance where a cylinder had been re-bored and a general overhaul given to it by Messrs. Crossley Bros., about five years ago, it had worked, at first for nine months in the year, and latterly all the year through. At West Hartlepool, they did not use gas for this purpose; but they employed it in the shops. In the blacksmith's shop, they had fans blown by a small gas-engine; and in the fitting-shops, lathes, drilling-machines, and other machinery were all worked by gas power. He had not been able to introduce gas power further than that at Hartlepool—at least, not in his own works; but in various works in the town, they had from a ½-horse engine, which was used for a variety of purposes, such as printing, up to what, he believed, was until recently the largest single-cylinder gas-engine that had been worked. They would understand, of course, that there were double-cylinder engines which were much larger. He had the privilege some time ago of taking several diagrams from this engine, which was used for steel drawing in connection with wire-rope works. It was a 60-horse power engine; and he saw it indicate up to 118-horse power. The cost for this was 0·43d. per indicated horse power per hour.

They had with them that day a gentleman who had taken very great interest in what steam-engines were doing, and what they ought to do; he alluded to Mr. Woerth. Possibly he might be disposed to tell them whether or not the results he had stated compared with the modern results of a steam-engine. He should very much like to know this for his own information. Regarding the general consumption of gas for engines, he found that, out of a total sale of 255 millions, they were selling about 10 million cubic feet for gas-engines alone. This was certainly not so high as Mr. Lees had given as having been obtained at some other places; but almost every alternate week, they had someone either inquiring for gas-engines, or having them fixed, so that they had hopes of better results. In the meanwhile, they gave those who used gas-engines all the advantages they could, except that they did not reduce the price of gas. Their figure was 2s. 4½d., or 2s. 3d. net. They fixed the engines; and they were prepared to lay down, at their own cost, larger services, and furnish all the accessories that were necessary for the engines, without putting the consumers to the expense of doing this. This they had found to be of very great advantage, because if, in the first instance, an individual was contemplating getting a small 2 or 3 horse power gas-engine, at a cost of £50, and he was confronted with an additional £10 or £15 for services, it would be found that this would very often be the deciding-point for or against the engine. He thought gas companies ought to encourage as much as possible the use of gas-engines, by doing what they could to supply what they might almost term outside matters. They had gas-engines in use also for shipyard purposes. It was a good old saying that "It's an ill wind th' blaws naebody good;" and the late trade disputes had brought gas undertakings some good with respect to the introduction of gas-engines. They had a dispute in one of the shipyards at Hartlepool; and they were not able to keep their works going so satisfactorily as they would have liked. The result was that they had put down 6, 12, and 3½ horse power gas-engines, in order that they might be able to cope with any dispute that might arise. Before that the firm were very much opposed to the introduction of gas; but latterly, he believed, they had been perfectly satisfied not only with the results of their working, but also with regard to the cost. They had another shipyard in which there was a 16-horse power gas-engine, which did the bulk of their general turning work instead of steam. Of course, they had steam as well; but the larger portion of the work was executed by gas. All this tended very materially to increase the day consumption of gas; and he had of late noticed the fact that the ratio of increase in their make was very considerably higher during the summer months. He was, of course, speaking proportionately to the make of gas compared with the winter months. The ratio of increase from the 1st of February to the 1st of November was very much larger than during the winter months. This plainly proved to his mind that they were getting a very considerable benefit, first from gas-engines, which worked with their gas mostly during the daytime; and, secondly, from the cooking and heating appliances they had fixed. Electric light and oil were competitors which took away a portion of their consumers; but they were more than compensated for this by the consumption he had just mentioned. He thought, therefore, all things considered, they should use every effort to stimulate the demand for gas for power in every way they possibly could. He, for one, was personally indebted to Mr. Lees for the information he had put before the members, which would be recorded in their transactions. He must have been at considerable trouble in obtaining it; and the Association were much indebted to him.

Mr. R. J. Woerth (Stockton) said the best engine he ever met with consumed a hundredweight of coal per horse power. A very good engine in Birmingham was certified to consume 8·36 lbs. of coal per horse power per hour; but the fact was that an engine could be had which would use not more than 4½ lbs.—some very much less. At the same time, although he was an engine builder himself, he did not in any way oppose the introduction of gas-engines—in fact, there were many cases in which he told his customers that they ought to get an engine. In small works certainly a gas-engine was best. Suppose they wanted 10-horse power. This would cost them for gas, as nearly as possible, 5d. per hour, with gas at 2s. per 1000 cubic feet. With a steam-engine, it would cost them 3d. per hour; but they would require a man to look after the boiler, and this balanced it. When they came to 30-horse power, they found they had just as much saving as would pay a man's wages; and the outlay would be little more with steam. They might therefore take it that with 30-horse power the steam would pay. But in the case of an engine of the power in question—118-horse power—the case was entirely altered. At 0·43d. it came out at not quite 4s.; while a steam-engine, if it were in a position where a condensing-engine could be used, would get on with about 2¼ cwt., and they would have to add something for waste, and 2¾ cwt. of coal would be used if no water could be had for condensing. If it was to be a high-pressure engine, it would get on with 4 cwt. of coal per hour; and with coal at about 10s. per ton, the cost would be 2s. 8d. for the steam-engine as against 4s. for the gas-engine. When they came to large sizes, the gas-engine did not pay; but up to 30-horse power it generally paid, unless there were other circumstances which required steam. In any reasonable-sized works, however, they could burn up rubbish which they would otherwise have to cart away.

Mr. Bower said he intended to have asked a question. He thought it possible there might be some gentleman present who was connected with the manufacture of gas-engines. It was an inquiry which had been made of him several times; and he had not been able to give a satisfactory answer to it. It was as to what quantity of water per indicated horse power was used in cooling the cylinders.

Mr. S. J. Nichols (Darlington) said he had no doubt that for small works a gas-engine was a very useful article; but in larger works, like his own, making 200 millions a year, it would be very difficult to employ gas for all purposes, seeing that they had so many purposes for which they used steam, as for the exhausters, condensers, and washer-scrubbers. In his own case, he also had the hauling-in of coal from the railway; so that it would be seen that it would be impossible to employ gas-engines in large works. So far as these engines were used for other purposes, he might say that in Darlington they were increasing very rapidly. Only recently a 16-horse power gas-engine had been put into a hotel to generate electricity; and it had come to his knowledge that another engine, of 30-horse power, would be put down for manufacturing purposes.

Mr. W. D. Gibb (Newcastle) said he really could not agree with Mr. Lees, who said the method of getting a steady run was by bye-passing, as this was losing power. They were told that large gas-works were not so good as small ones for gas-engines. But the works in which he had lately been extended over a large area; and they were the very place for gas-engines, because they had to use them for pumping at the extremities of the works, and it would be impossible to carry steam so far without condensation. In their case, they used gas-engines for driving the machinery in the repairing-shops and for pumping; and he thought the cost was about 8d. per 1000 cubic feet. They had a gas-engine which they could run at the cost of about 1d. per hour; and also a 2½-horse power engine, which they could run for about ½d. per hour. As regarded exhausters, his experience was that gas-engines were not very suitable for them. It was desirable to lower the cost of gas-engines, so long as it could be done consistently with good workmanship. They were all indebted to Herr Otto and Messrs. Crossley Bros. for the manner in which they turned out their gas-engines while they held the principal patents. It was on this account, in great part, that these engines had such a good name.

Mr. E. H. Millard (Durham) said that one thing had not been brought out—viz., that if they had the gas supply to an engine connected to their make, the engine was the very thing that would tell them at once if anything was wrong, as it would soon begin to bang. His experience of regulating was that trouble in connection with it was practically *nil*, if they had a bye-pass large enough. In the winter time, they opened the bye-pass; and it cost very little more to run the engine. The cost of gas was a mere bagatelle compared with having the exhauster running. As their make of gas decreased, they could keep on regulating. They would not require to alter the pulleys on the exhauster more than at the beginning and the end of the winter. One point had been very well brought out, and that was that a steam-engine would work although the slides were very bad; but a gas-engine would not, as he had several times found to his cost. At the place where he was formerly, they had but one gas-engine; and the result was that just when they were very heavily pressed the engine failed. It was therefore very essential that the plant should be doubled. In all large works, the steam-engines were in duplicate; and therefore in small ones the gas-engine should be also. He had taken great interest in pushing the gas-engine—so much so, indeed, that he came to be at everybody's beck and call when anything went wrong with one. It was a decided advantage to be able to give advice. He would warn managers of small works to be very careful how they increased their pressure when they introduced gas-engines. They would be very often asked to do so. With respect to a special price for gas to be used in engines, he quite thought that some allowance ought to be made; but any concession in this direction should apply equally to other ways in which gas was employed. As one method of dealing with this point, he brought before his Committee, in his former situation, the advisability of charging a differential price; but in this way—that, instead of charging by quantity or for special purposes, they should lower the price all round during the summer months—in other words, make a difference of about 6d. per 1000 cubic feet between the winter and the summer price. He thought this would meet everybody's views. He congratulated Mr. Lees on the large amount of information contained in his paper, which, he thought, would be very useful.

Mr. Nichols explained to Mr. Gibb that his boiler happened to be right in the centre of his works. If he had to go a distance, he should certainly use a gas-engine.

Mr. J. Hall (West Pelton) thought Messrs. Crossley Bros. were indebted to him for one patent. When he was at Berwick-on-Tweed, a 12-horse power gas-engine was erected in a low-lying part of the town; and all the pressure he could put upon it would not make the engine work at certain points. He gave a great deal of study to the subject, and ascertained where the difficulty was. He found that when they put the touch of the gas-engine in close proximity to the gas supply, they could not get the engine to work. If they wanted a gas-engine to act properly, the action of the touch should be a good many yards away, as the pulsation of the engine destroyed the touch.

Mr. G. T. DUNCAN said, as representing a firm of gas-engine makers, he should like to point out that some of the figures put before them were not applicable generally. It had been stated that a steam-engine of one make could be worked with a consumption of 5 lbs. of coal per indicated horse power per hour; and that in sizes above 30-horse power, the steam-engine was the more economical motor. He thought it ought to be borne in mind that gas companies had very strong opponents in the makers of producer gas; and, in connection with these figures, he thought it was desirable to bear in mind that, for large powers, this gas plant could be put up cheaply, and that, using coal, the consumption was about 1 lb. per indicated horse power per hour, and with coke 1½ lbs. per indicated horse power. He had in his hand some figures which had been recently given to him, showing the result of working gas-engines of 140 indicated horse power which they had recently put down; and in that case the consumption came out exactly at 1·05 lbs. of coke per indicated horse power per hour. He thought that gas managers generally should bear in mind that their opponents were present, and that it would possibly be to their interest to keep as low as possible the price of gas for use in engines. He happened to know of a company who intended to put in some gas-engines. They approached the local gas company with the object of obtaining a reduction, but did not get what they asked. The result was that they put down a gas plant of their own; and the gas company now had nothing from them. His opinion was that if the price of coal gas could be reduced to 1s. or 1s. 3d. per 1000 cubic feet, there would be no need for such plant, because the gas produced was not so good as coal gas, and did not go so far. A gentleman referred to the cost of repairs on gas-engines. He thought it only right to state that the slide was now obsolete—having been superseded by tube ignition. Gas-engines were now being used very extensively in some of the large shipbuilding establishments in the North of England in conjunction with coal gas. One firm not far from that room had no less than ten engines, some of them of 50 indicated horse power; and he had information to the effect that, notwithstanding that they were using the town's gas, they were able to show the good round saving of about £50 per annum. There was a firm in Newcastle who had a 7-horse power gas-engine; and, though they ran it for about nine hours a day, they found the cost only 6s. per week. They had no attendant for it. But prior to the introduction of the engine, they had a man who was paid 25s. to 30s. a week in wages; so that the saving in this case was very marked indeed. He was sorry he could not answer Mr. Bower's question as to the quantity of water per indicated horse power which would be required to cool the cylinders.

Mr. DRAKE said he had had a 16-horse power gas-engine for four or five years; and he found that his water bill ran up to about 2000 gallons a year. He paid 1s. 8d. for it; but the Corporation charged him 6s. for a meter. He did not think it paid to run the water through an engine and let it go to waste. He worked twelve hours a day, at an average cost, for gas, of about 5s. per week.

The PRESIDENT expressed his pleasure that the discussion had extended so far, and had been so general. As against Mr. Woerth's figures, perhaps the members would have seen a report recently that a gas-engine was to be fitted for use with producer gas, to take the place of a steam-engine at a Surrey paper-mills, and that the saving expected was about £1000 per annum.

Mr. LEES, in reply, said the discussion had been so long and so varied that he had some difficulty in dealing with all the points raised. Mr. Hardie had asked a question as to the cost of gas into the holder. So far as his memory served him, it came to about 11d. per 1000 cubic feet—he thought a little over than under that figure. He was prepared to admit that it was practicable to work at less cost than the figures he had given; but they were the actual figures for the electric light. It was, of course, quite possible to get Mr. Woerth's results; but they were not here dealing with a Utopian idea, and were not working with perfect engines. They had to deal with engines as they found them. On the subject of employing steam in gas-works for cleaning out washers and scrubbers, his opinion was the plant was sometimes neglected because it was known that, by turning on steam, they could put the matter right; but difficulties arose which made them wish they had never seen steam. Mr. Gibb had stated that his experience was that gas-engines were not so useful for exhausters. Well, that had only reference to exhausters in small gas-works. He did not know what would be the comparative cost for works of such size as Mr. Gibb was connected with; but he did know that, in his own case, he would be safe in asserting that steam would be far more costly than gas. Mr. Gibb said it would be a loss of power to bye-pass the gas. This might be so; but, granting the loss of power, he still held that it would be cheaper to use gas. Mr. Millard had alluded to the gas-engine, if connected to the make, letting them hear if anything was wrong. Their gas was not so connected; but he had a case where there was a gas-engine; and it went on for two or three hours without his knowing it. How it did so he could not understand. Mr. Millard also referred to differential prices. He did not say whether or not his Committee adopted his suggestion; but he (Mr. Lees) could imagine what the experience would be. If they reduced the price of gas in summer, there would be a great outcry when they raised it in winter. Mr. Duncan made some remarks about gas-engines. No doubt it would be a great pleasure to every gas manager if he could reduce the price to from 1s. to 1s. 3d. per 1000 cubic feet; but they could not do this for gas-engines, and charge the ordinary consumers from 2s. 6d. to 3s. This would be a system of "robbing Peter to pay Paul," which they could not have. He said that producer gas cost 3d. or 4d. per 1000 cubic feet. As a matter of fact, in some of the works he had mentioned, the price of gas was reduced to 1s. 6d.; so that he did not think there was any necessity for reducing it to 1s. or 1s. 3d. Where they could sell gas for 1s. 6d. per 1000 cubic feet, he thought they could meet all the competitors they could think of. They could not carry on a gas-works as a philanthropic institution. He was glad the discussion had been so long and so useful. He was afraid that, having been kept "in steep" for six months, the paper might not be very kindly received; but he was much obliged to those who had spoken upon it for the kind remarks they had made.

Mr. Theodor Petersen's paper, describing Burmeister and Wain's method of separating tar rom ammoniacal liquor, is unavoidably held over for a subsequent issue.

Heywood Corporation Gas and Water Accounts.—At the quarterly meeting of the Heywood Town Council last Wednesday, Alderman Firth, Chairman of the Gas Committee, stated that a profit of £934 had been made on the last year's working of the gas undertaking; and it was proposed to hand over £300 of this amount towards the reduction of the rates. It had been decided to lower the price of gas for ordinary purposes to 3s. 2d. per 1000 cubic feet, and for stove and motive power to 2s. 9d.—a reduction of 4d. Alderman Cronshaw afterwards reported that the loss on the water undertaking for the year was £1370, as against £3058 in the previous year.

Southampton Gas Company.—The half-yearly meeting of this Company was held last Wednesday week. The report submitted by the Directors showed that the amount available for dividend was £10,880. From this sum they recommended the payment of the maximum dividends (less income-tax), amounting to £7894 for the half year; leaving a balance of £2986. It is satisfactory to note that during the six months there was an increase of 5,607,000 cubic feet in the quantity of gas sold as compared with the corresponding half of 1892. For the whole of 1893, the increase was 15,879,000 cubic feet. Referring to the sale of 200 £25 "A" shares in February last, the Board stated that they realized £7514—being an average of £37 11s. 4½d. per share; the premiums amounting to £2514. The Chairman (Mr. R. C. Hankinson, J.P.), in moving the adoption of the report and accounts, congratulated the shareholders on the continued prosperity of the concern. As the report stated, the additional consumption of gas last year was 15,879,000 cubic feet; and this still went on. A most satisfactory feature was that a great deal of this increase—one-third, in fact—was in day consumption; and it arose from the extended use of gas cooking-stoves and engines. They had 701 cookers on hire, which, of course, were exclusive of those owned by consumers. There had been 689 tons more coal carbonized than in the previous half year. He was glad to say the Company had been in no difficulty with regard to their coal contract, although they had been obliged to keep a larger stock than usual; but their contractors had behaved most liberally to them. Then as to the residual products, he was glad to say the Directors had entered into a contract for tar more favourable than they had had hitherto. This would extend over three years, and would substantially increase their income. The coal contract, too, was at a low price, and would extend to June, 1895. In conclusion, he testified to the efficient manner in which the works were conducted. The report was unanimously adopted.

Visit of Gas Engineers to the Elland Gas-Works.—In connection with the exhibition of gas appliances held last week under the auspices of the Elland-cum-Greetland Gas Company, to which reference is made in a paragraph in another part of the JOURNAL, the Company's Engineer (Mr. R. Porter), in conjunction with the Directors, invited a few professional friends to view their works. Upwards of twenty accepted the invitation; and on Wednesday last, under Mr. Porter's guidance, they inspected the plant and appliances. Special interest was shown in the coal elevating and conveying plant, to which reference has been already made in our columns, which has been designed to meet requirements of a very exceptional character; as well as in West's stoking machinery. In the purifier-house, a special feature was an extremely light but serviceable circular roof. Coming to the distributing plant, much attention was given to Braddock's patent automatic pressure changer as applied to the Elland governor; Mr. Porter explaining at some length its principle and mode of action. Among some other novelties was noticed a very simple but effective hydraulic apparatus, by means of which cast-iron mains may be taken up and relaid without receiving breakage or damage. After the inspection, the party proceeded to the Town Hall, and made a careful survey of the exhibits; expressing themselves highly pleased with the general arrangements. Here they were received by the Chairman (Mr. J. Dodgson) and some of the Directors of the Company, at whose invitation they partook of tea. After tea, the Chairman gave an outline of the history of the Company. He said that not only had their attitude towards the consuming public become that of manufacturer to customer in the selling department simply, but great attention had been given to the study of the most modern and scientific plant obtainable. Acting on the suggestion of their present Engineer, he considered their works now ranked second to none, and were well worth a visit from any gas manager. He thanked those present for the respect and esteem they had that day shown towards Mr. Porter, which only proved to him that their confidence as Directors had been well placed. A hearty vote of thanks was accorded to the Directors for their invitation and hospitality; and the company dispersed.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress has been made with Bills:—

Bills read the first time and referred to the Examiners: Dundee Corporation Bill, Electric Lighting Provisional Orders (No. 5) Bill, Fulwood Local Board Water Bill.

Bill read a second time and committed: Paignton Gas Bill.

Bills read the third time and passed: Aberdare Local Board Water Bill, Abertillery Local Board (Gas and Water) Bill, Edinburgh and Leith Corporations Gas Bill, Falkirk Corporation Gas Bill, Kendal Corporation Gas and Water Bill, Millom Local Board Bill, Newcastle and Gateshead Water Bill.

HOUSE OF COMMONS.

The following progress has been made with Bills:—

Bills presented and read the first time: Aberdare Local Board Water Bill, Abertillery Local Board (Gas and Water) Bill, Edinburgh and Leith Corporations Gas Bill, Falkirk Corporation Gas Bill, Kendal Corporation Gas and Water Bill, Local Government Provisional Order (Gas) Bill, Millom Local Board Bill, Newcastle and Gateshead Water Bill, Wakefield Corporation Bill.

Bill read a second time and committed: Electric Lighting Provisional Orders (No. 1) Bill.

Bills reported: Bury Corporation Bill, Gloucester Corporation Bill, Torquay Gas Bill.

Bills read the third time and passed: Dundee Corporation Bill, Fulwood Local Board Water Bill.

HOUSE OF COMMONS COMMITTEE.

(*Before Sir* JAMES KITSON, *Chairman; the Marquis of* GRANBY, *Mr.* J. G. LAWSON, *Mr.* BURNIE, *and Mr.* BONHAM-CARTER, *Referee.*)

Monday, May 7.

PLYMOUTH AND STONEHOUSE GAS BILL.

This Bill, the principal objects of which are to authorize the Company to raise additional capital, to convert their existing capital into stock bearing a maximum dividend of 5 per cent., and to vary the provisions of the sliding-scale of price and dividends, came before the above-named Committee to-day.

Mr. POPE, Q.C., Mr. CRIPPS, Q.C., and Mr. BASSETT HOPKINS appeared for the Company; and Mr. BALFOUR BROWNE, Q.C., and Mr. FREEMAN represented the Corporation of Plymouth, the only opponents of the Bill.

Mr. CRIPPS, in opening the case for the promoters, said the chief object of the Bill was to raise further capital, in order to deal with the increased demand and the necessity for additional works. At the present time, as was the case with a large number of old gas companies, the stock consisted of a 10 per cent., a 7½ per cent., and a 7 per cent. stock. By the Bill, they proposed to convert it into a uniform 5 per cent. stock; and by the manner in which it had been amended, the transfer was made on such a basis that there was no advantage to the existing shareholders. The position of the Company was almost unique. He believed no other Company charged so low a price; it being 1s. 9d. per 1000 cubic feet. Although the Company obtained their coal from Newcastle, they could supply gas at a cheaper rate than it was supplied at there; this being the result of good management and the excellent condition in which the buildings and retorts were. There was no allegation of any complaints against the Company; for they had not only managed their business on the most economical basis, but in such a way as to satisfy the consumers. The standard price was 2s. 6d. per 1000 cubic feet; and by the operation of the sliding scale, as they supplied gas at 1s. 9d., they were entitled to divide 12½ per cent. The illuminating power was 14 candles; and though this was lower than was adopted by most other gas companies, in this case there were reasons why it should be maintained. The consumers were satisfied with the quality, inasmuch as practically they had an illuminating power of 15½ candles; and the standard could not be raised without increasing the price. A large proportion of the gas was used for heating, cooking, and manufacturing purposes, for which the consumers would not be advantaged one iota if the standard were raised. The evidence of expert gas engineers would satisfy the Committee as to the purposes for which the additional £100,000 was required.

Mr. *G. Henderson*, Chairman of the Company, was then examined as to the financial position of the concern. He said that at the time of the works being taken over from the United Gas Company, in 1844, the price charged was 9s. per 1000 cubic feet. Having indicated in detail the successive steps by which it was reduced to its present figure, he said that since the last application of the Company to Parliament, in 1878, the consumption had doubled; and they were now carbonizing about 60,000 tons of coal per annum. In 1878 the proportion of capital per ton of coal carbonized was £2 16s.; and now it was about £1 19s. At the former period, they made 4 million cubic feet of gas for every £1000 of capital; whereas now they produced 5½ million cubic feet. He was not aware that there was any other company in existence whose capital, in proportion to production, was so low. To meet the increased demand, the Company required additional manufacturing power and storeage room. They had 117 gas-engines at work in the town; and the number was continually increasing. The consumption of these engines was about 30 million cubic feet; and there was also a large supply for cooking and heating stoves. The Government establishments consumed 16,623,000 cubic feet; and the public lights were kept going the whole night through. The raising of the standard of illuminating power would necessarily mean increased cost; and any advance in price would tend to restrict the consumption. The consumption being so large in proportion to the capital was due to the fact that they were supplying gas at so low a price. The Company was formed by consumers, in order to obtain gas at the lowest possible rate; and the Directors always had this in view in conducting the affairs of the undertaking. If ever a company had carried out the objects for which it was formed, and realized them, he maintained it was the Plymouth Company. The outside Local Authorities did not in any way share in the opposition of the Plymouth Corporation, and were perfectly satisfied with the administration of the Company's affairs.

Cross-examined by Mr. BALFOUR BROWNE, witness said it was not the fact that the reason of their capital being low was that money had been spent on capital account out of revenue. For several years they had been content with a 6 per cent. dividend; and the surplus profits were laid out in extending and improving the works. If they had paid for this out of capital, the price of gas would have been so much higher. The Company had had power to borrow £20,000, which they might have raised at 4 per cent.; but by turning it into share capital, and paying 7½ per cent. upon it, there was a difference of £750 a year. He did not consider that this came out of the pockets of the consumers. They had also power in 1879 to borrow £15,000. But by the Act of that year, they were prevented turning it into shares; and they had not raised a penny of this £15,000. Lord Redesdale approved of the course they adopted, and sanctioned it; saying they were a model Company, because they did not borrow any money at all. He preferred companies carrying on their works on their own share capital. If the power to raise the additional £100,000 were given, he thought it would make provision for about 14 years. On the last occasion of the Company coming to Parliament, the illuminating power was raised from 10 to 14 candles; and he estimated that to raise it an additional candle would cost 1½d. per 1000 cubic feet.

Mr. *G. Livesey*, examined by Mr. POPE, said he claimed the credit, or discredit, whichever way they liked to put it, of the sliding-scale; but Lord Farrer was the author of the auction clauses. He had visited the Plymouth works, and satisfied himself that the provisions of the Bill were legitimate. In the matter of gas enterprise, the position of the Company was unique. They had by a long way the smallest capital per ton of coals carbonized of any company in the kingdom, and were selling gas at the lowest price. The small capital was, no doubt, due to great economy in the spending of money, and probably to the application of a certain portion, derived from revenue, to the extension and improvement of the works; but he did not know whether or not it came out of the consumers' profits. If the Company had done as other gas companies had, they would have raised in the past a very much larger amount of capital on which the consumers would have had to pay interest; so that instead of getting gas at 1s. 9d., they would have had to pay at least 6d. per 1000 cubic feet more. If the consumer in the past had suffered, the present consumer gained considerably. The proposed extensions would be calculated to cause cheaper production, and help the Company to adopt the most modern labour-saving appliances. The capital asked for he considered a moderate amount, and would enable the Company to keep out of Parliament less than 14 years. He would recommend that they should be restricted to the exercise of their borrowing powers before the issue of fresh capital. The conversion of the old capital would enable them to issue the new at a lower rate of interest, which would be to the advantage of the consumer. The standard price of 2s. 6d. was deliberately fixed by Parliament; and, if altered, it would not only affect the stock of the Plymouth Company, but stock all over the country. Even if it were too high, it would be detrimental in the public interest to tamper with the initial price; but in this case he considered it ought not to be reduced, as it was the lowest in the kingdom. As to the increase in illuminating power, it was not worth what it cost. The proper principle to go upon was that the consumers should be supplied with the best gas that it was possible to obtain from the available coal supply without enrichment. The cost of cannel had gone up to such an extent as to make it practically prohibitive; consequently the companies had had to resort to petroleum, which was vaporized and put into the gas. This increased the lighting power at the testing-place; but as the vapours condensed in the mains, the consumer did not really get the benefit of it, though he paid for it. The best means of raising the illuminating value of gas was by the use of the most improved burners, by which means gas had on the Continent driven out, or checked the use of, the electric light.

Cross-examined by Mr. FREEMAN as to the charges for the public lamps, witness said the public were entitled to gas at the lowest rate charged to any private consumer; and if the Plymouth Company charged more than the amount out of pocket for lighting, cleaning, repairing, and providing the lamps, they asked for too much.

Mr. FREEMAN: That is a perfectly fair concession.

Witness, questioned as to whether the capital asked for by the promoters was not excessive, and would enable them to keep out of Parliament for 30 years, answered in the negative. He said that in the £60,000 for the completion of the new works, he did not think a gasholder was included. The storeage at present was only 66 per cent. of the consumption, and it ought to be 100 per cent. The electric light, which the Corporation of Plymouth were entitled to supply, he did not think would compete with the gas supply, on account of the difference in price. If the gas consumers were fairly treated, the electricians would have very hard work to entice them away from their old allegiance. On the other hand, if they were arbitrarily treated, there was a great deal of human nature in them; and they might take to the electric light at whatever cost.

In reply to Mr. BONHAM-CARTER, as to the reason why he claimed that the Company should be allowed to borrow to the extent of one-third of their capital instead of the usual amount of one-fourth, witness stated that he did so on the ground that borrowed capital was raised at a lower rate of interest than share capital, and therefore it was to the advantage of the consumers.

Mr. *T. Newbigging*, M.Inst.C.E., examined by Mr. BASSETT HOPKINS, said he had been advising the Plymouth Company on engineering questions for 34 years. The number of retorts possessed by the Company was 720; and the whole of them had been in action at mid-winter. The maximum producing power was 3,500,000 cubic feet per

day; and the maximum production last winter was 3,323,000 cubic feet. There ought to be at least 20 per cent. retort reserve to meet contingencies; and the Company were now engaged in increasing the number of retorts to 900. The other parts of the plant were not sufficiently extensive for safe working, and needed to be enlarged and supplemented. There were four gasholders, the capacity of which was 32 per cent. below the maximum daily make; whereas there ought to be storeage for 1¼ or 1½ days. The contracts entered into for extensions came to £49,000; and £37,000 more would be required to complete the necessary works. Besides this, a considerable outlay was necessary on enlargements and extensions of the distributing plant. If the growth of Plymouth continued at the present rate, he considered that the provision now being made would be exhausted in 11 or 12 years. He thought it would be a breach of faith on the part of the Legislature to alter the standard price; while if the illuminating power were raised, the charge for gas would have to be increased by 2d. per 1000 cubic feet. He agreed with Mr. Livesey that the raising of the standard of lighting power was scientifically unsound; and he had been opposed to it for years. But it was only within the last year or two many gas engineers had ventured to speak about it, because it seemed to a large extent to be going against the stream.

Cross-examined by Mr. FREEMAN, witness stated that he agreed with Mr. Livesey that the gas to be supplied should be such as the available coal would produce. In Lancashire and Yorkshire, they were in the midst of a richer coal-field, and could afford, without difficulty, to give a higher illuminating power without enrichment. But in the case of Plymouth, they were bound to get the coal from Durham at a reasonable price; and this would not supply more than about 14 or 14¼ candle gas. The principal items in the expenditure of £49,000, for which contracts had been made, were: Retort-house, coal-store, and gasholder and tank, £15,412; regenerative furnaces and settings, £5456; stoking machinery and elevators, £4740; and hydraulic mains, ascension-pipes, &c., £3857. In the contemplated further expenditure of £37,000 were included a gasholder, £15,000; station meter and governor, £3750; and washer and engine connection, &c., £1300. Beyond that, there would have to be an additional holder and various other portions of plant; also an extension of the mains, and possibly another retort-house. The present extension would only make 2¼ million cubic feet per day. The retorts now in use were very small (only 14 inches in diameter); but they did not make a low return, compared with their size. The new ones would be much larger. He did not attach any importance to the electric light as a competitor with gas in Plymouth.

Mr. *Vivian B. Lewes*, F.I.C., F.C.S., Professor of Chemistry at the Royal Naval College, Greenwich, and Superintending Gas Examiner to the Corporation of London, gave evidence on the question of illuminating power. Gas well made from Durham coal distributed very well, and the fall in illuminating power would be very slight; but if enriched artificially, it would lose its power much more rapidly than natural gas. There was also a greater want of uniformity in the enriched gas. A gas manager who had to distribute gas, testing for 14 candles over the area supplied, would have to send it out at about 15 candles. He estimated that the cost of enrichment would be something like 1½d. per candle over and above its natural illuminating power. The light to be obtained from gas of a given illuminating power was absolutely and entirely dependent upon the burner that was used. When they spoke of 16 or 14 candle gas, it meant that the gas should be consumed at a given rate of 5 cubic feet per hour, in a standard Argand burner; and under these conditions only did they get a light of 16 candles.

The CHAIRMAN, interposing, said that Professor Lewes confirmed the scientific evidence given by Mr. Livesey; and, if so, it was not necessary to go further into that point.

Mr. BASSETT HOPKINS said he called the witness as he was specially competent to speak to the question of the action of coal gas.

In cross-examination by Mr. BALFOUR BROWNE, witness said that in London the standard was 16 candles, which, he thought, was much too high; and the fact of the action of the County Council having secured that standard from Parliament, did not prove it to be the right thing. At the Beckton works, the enriched gas was sometimes nearly 18 candles; but it lost power rapidly in the distribution. As to the elimination of the sulphur compounds, he thought that a gas company should be hampered as little as possible; and that if they could get a coal that would not give above 30 grains of sulphur compounds, this amount might well be left in it. One of the disabilities of the London Companies was that they had to reduce them to 22 grains.

Mr. *R. N. Worth*, Chairman of the Local Board of Compton Gifford, one of the outside districts supplied by the Company, gave evidence as to the amount of gas consumed in the district, and to the satisfaction of the Board and the inhabitants generally with the supply given by the Company.

Mr. *C. E. Bean*, Public Analyst and Gas Examiner at Plymouth, stated that the maximum illuminating power of the gas had been well maintained, and that it had risen to as high as 15·32 candles. He had not found sulphuretted hydrogen on any occasion; and he considered the gas to be of fair quality.

Cross-examined by Mr. FREEMAN, witness stated that the apparatus with which he tested was not a modern one. He had no means of reversing the disc during his experiments; and the thermometer attached was broken. Therefore his observations would not be quite accurate; and any inaccuracies would tend to be slightly in favour of the Company.

Tuesday, May 8.

On the Committee re-assembling to-day,

Mr. BASSETT HOPKINS handed in detailed figures of Mr. Newbigging's estimate of the amount of capital which would be needed for the next 11 years; of the contracts which had been accepted, and the further expenditure which would be required at once, or very soon; and of the consumption of gas for other than illuminating purposes, which was one-third of the total; and a statement of sums charged against revenue for renewal and depreciation of plant, amounting since 1847 to £58,026 16s. 7d.

Mr. *H. Reed*, the proprietor and manager of the Grand Theatre at Stonehouse, said that both that theatre and the Theatre Royal at Plymouth were supplied with gas by the Company. In a theatre, light was, of course, very important; and if there were anything the matter with the gas, it would be noticed, and complaint would be made. His experience of the Company's gas was that it was very good indeed; and he had never had reason to complain as to its quality or its regularity of supply.

Mr. *W. W. Blight*, Chairman of the Stonehouse Local Board, said the township was supplied with gas by the Company, and there had never been any complaint by his Board as to the quantity or the quality of the gas. The Company's Bill had been considered by the Board, and they saw no reason whatever to object to it. The consumption of gas for other than illuminating purposes in Stonehouse had been very much increasing lately. There were a number of small factories now using gas-engines, because the gas was so very cheap, and because it was more handy; and gas-stoves also would be used by the inhabitants generally.

Mr. FREEMAN: Was any report made to you in connection with this Bill, as to the way in which the Company had been dealing with their funds in the past, and to the effect that, if they had done their duty, your gas would have been very much cheaper?

Witness said no. It had been reported to them that the Company had done everything most satisfactorily; and they had given them very cheap gas. He was not aware that revenue had been applied to capital expenditure, or that, under the provisions of the Gas-Works Clauses Act, when they were paying a certain dividend they were bound to apply any surplus profits in reduction of the price of gas.

If those things had been brought to your Board's notice, would they not have assumed a different position towards the Bill?—I cannot tell you what they would have done.

In re-examination by Mr. BASSETT HOPKINS, witness said that, if the Company applied money, which they might have divided among themselves, to the construction and extension of works, he considered that they had done wisely, and that it was creditable rather than discreditable to them.

Mr. *S. Vosper*, the Managing Director of the Plymouth Breweries Company, and the Chairman of the Lighting Committee of the Stonehouse Local Board, gave corroborative evidence as to the satisfactory supply of the Company.

Mr. BALFOUR BROWNE, in addressing the Committee against the Bill, said he did not think it would be necessary for him to call any evidence on the four or five points raised by the Corporation in the interests of the consumers of gas, as the evidence for the promoters was all that could be desired. The only evidence which the Committee might possibly think he should have called was as to the question of the illuminating power; but he urged that the onus was on the promoters with reference to this. The Company were seeking to do what had not been done by Parliament in any case. They were seeking to continue a 14-candle gas against the wishes of the consumers, whom he represented; and he defied them to show one single precedent in the last ten years where gas of this standard had been allowed. He had gone through all the precedents since 1888; and, out of 86, there was only one in which 14-candle gas had been permitted—all the others being 15 or 16 candles. The coal carbonized at Plymouth was the same as that used in London—Durham coal of like quality; and, if it was used fresh within a month after arriving at the works, it produced gas of 15-candle power. According to Professor Lewes's evidence, it was a gas that distributed exceedingly well; there being practically no change in illuminating power over the eight miles from Beckton to London. Why should not the Plymouth Company supply 15-candle gas, seeing that, if there was any loss on the distribution, it was the consumer who suffered, because the testing-place was at the works? The Company said that it cost 1d. per 1000 cubic feet more; but if the consumers were prepared to pay the penny, as they "paid the piper," surely they were entitled to "call the tune." They called the same tune that Parliament had enforced upon every gas company for the last ten years; and he did not believe the Committee would set a new precedent for the reduction of the illuminating power in gas at the instance of the Plymouth Company. Dealing with the financial operations of the Company, he urged that the whole object of the Bill was to put money into the pockets of the shareholders out of those of the consumers. The Company had claimed that they were desirous of doing the very best they could by their customers, as if they were philanthropists sacrificing their shareholders to the interests of the consumers. That this was not so was, he maintained, shown by the manner in which they had issued share capital at 7½ per cent., instead of borrowing at 4 per cent. He did not complain of this, because Parliament allowed them to do it; but if this was the fault of Parliament in the past, he wanted Parliament to be very careful not to fall into a similar error now, by passing the Bill in its unmodified form, which would inure to the disadvantage of the consumers of gas in Plymouth. Dealing with the proposed conversion of capital, he said that, under the sliding-scale, for the invention of which he thought Mr. Livesey deserved every credit, there was one serious error which that gentleman apparently did not perceive at the time, but which acted unjustly as between the shareholders themselves, and between certain classes of shareholders and the public. When the Company reduced the price of gas 4d. per 1000 cubic feet, they might increase their dividend by 1 per cent.; but the addition of this 1 per cent. represented a different proportion on the 7 and on the 10 per cent. stock. Thus the 7 per cent. shareholder obtained a greater benefit than the 10 per cent. shareholder. By the conversion of capital, they were stereotyping this difference for all time. As to the capital now proposed to be raised, he contended that it was far more than was necessary; and, taking into account their borrowing powers, he thought a capital of £100,000 would be ample. Criticizing the action of the Company in past years in applying revenue to capital account, he said that the Company had made the consumer of the past pay for the consumer of the present; and this was why they were now able to manufacture gas so cheaply. The question of the standard price was, however, the most important. When standard prices were originally fixed, people were very much in the dark as to what was a fair amount to name. The idea was that

the standard should be the maximum price to enable them to pay the maximum dividend; but it was never intended to give a company a price which would enable them to pay 12¼ instead of 10 per cent., and 9¾ instead of 7½ per cent. The whole policy of Parliament had been in the direction of the reduction of dividends; and he considered that a standard price of 2s. would be a fair margin over the present selling price of 1s. 9d. The learned Counsel was proceeding further to urge the cutting down of the capital powers, and to contend that the amount granted should not exceed £100,000 altogether of share and borrowing powers, when

Mr. LAWSON called his attention to the fact that the promoters had agreed to raise their loan capital before they issued their shares.

Mr. BALFOUR BROWNE said this was to some extent good; but his point was that, if the Committee gave the Company a very large amount, it would enable them to remain longer away from Parliament. He urged that the Bill should only be allowed to proceed with the modifications he had suggested as to capital, illuminating power, and standard price.

Mr. CRIPPS claimed the right of reply as to the standard price.

Mr. BALFOUR BROWNE objected to this course.

Mr. BONHAM-CARTER said the Chairman felt that the Committee were not sufficiently informed upon the very intricate question of the standard price. They proposed that the preamble of the Bill should be passed; and when they came to the clause dealing with the subject, they could further discuss the matter.

After some conversation as to procedure, the Committee deliberated in private. On the re-admission of the parties,

The CHAIRMAN said the Committee had decided that the preamble of the Bill, as amended, had been proved. They had arrived at the following decisions with regard to the provisions of the Bill: First, the illuminating power of the gas was to be 15 candles; secondly, the amount of capital to be authorized, whether raised by shares or by loan, should be £150,000. It was to be divided in the following manner: The amount to be borrowed in respect of the original capital of £206,000, £50,000; the additional capital, £80,000; the amount to be borrowed in respect of the additional capital, £20,000—making a total of £150,000. The above amount of £50,000 of loan capital to be raised before the issue of the additional share capital of £80,000. The conversion of the various stocks was sanctioned. The balance to be carried forward in any one half year should be limited to a sum not exceeding £10,000. The question of the standard price was deferred till the clause fixing it came under consideration.

Mr. CRIPPS said he quite understood the decision of the Committee; and it would take some little time to draft the necessary revisions to the Bill. As, however, the witnesses were present, they could deal at once with the question of the price.

The CHAIRMAN assented.

Mr. BALFOUR BROWNE said he did not propose to take any part in the discussion on this portion of the Bill.

Mr. *George Livesey* was then recalled, and said there had not been one instance, in all his experience—and he could say absolutely there had never been an instance—in which the standard price had been altered after having been settled. When it was once fixed, the capital was raised in reference to the standard price. The sliding-scale was first started in 1875; and about 1876 or 1877, the South Shields Gas Company obtained an Act, and the sliding-scale was applied to it. About the year 1881, they came to Parliament again, and a very strong attempt was then made to reduce the initial price; but the Committee refused to do so. In 1882, the South Metropolitan Company were in Parliament, having a standard price which was fixed in 1876. The Metropolitan Board of Works made a very strong attempt to get the price reduced; but Parliament again refused to do so. He could say positively that there had been no instance of any interference with the standard price after it had been once fixed.

Mr. CRIPPS: Let us go a little farther into the question of altering a standard price. Of course, as far as money has been raised in the past upon the standard price, the premium must have reference to the price at the time the money is raised?

Witness: Yes. These people gave £60,000 for £30,000 worth of stock on the faith of the sliding-scale, which entitled the stock to a dividend of 9¾ per cent. The standard price was, of course, a direct element bearing upon the terms on which money could be raised.

It seemed to be suggested that the standard price might be altered because the Plymouth Company can supply at such a low figure as 1s. 9d. That would mean, would it not, that, wherever a company were doing exceptionally well and economically, you might interfere with their standard price; and that, when they did not carry on their business so well and economically, you would leave it alone?—Yes. No company had ever applied to have the standard price raised; and I do not suppose that, if they had applied, it would have been granted. To alter the standard price would be disastrous to the interests of gas consumers all over the kingdom, because the effect would be that, instead of the companies raising their new capital at a little over 4 per cent. interest, they would get much less premium for the new stock, and consequently the rate of interest would be higher. I could not advise the Company to accept the Bill, introducing the novel principle of altering the standard price.

Mr. CRIPPS said he did not know if the Committee would desire further information upon this point.

The CHAIRMAN asked if the promoters could supply the Committee with information as to the standard prices along the coast.

Mr. *Newbigging* was then recalled to give this information. He said that at Exeter the price was 4s.; at Southampton, they were not under the sliding-scale; at Portsmouth, it was 3s. 4d.; Torquay was not at present under the sliding-scale, but they had a Bill now in Parliament asking for a standard price of 3s. 10d.; at Brighton, the lowest standard price was 3s. 3d.; at Eastbourne, it was 4s. 4d.; at Hastings, 4s.; Worthing had no sliding-scale; and at South Shields it was 3s. 3d. These figures were from the Board of Trade returns.

The CHAIRMAN said this was sufficient evidence; and the Committee would now decide on the clause.

After a short consultation in private, the Committee decided that the standard price should not be altered.

The remaining clauses were postponed till the 28th inst.

HOUSE OF COMMONS COMMITTEE.

(*Before Sir* JOSEPH PEASE, *Chairman*; *Mr.* BRUNNER, *Mr.* BAIRD, *and Mr.* RANKIN.)

Friday, April 27.

SOUTHWARK AND VAUXHALL WATER BILL.

At the sitting of the Committee to-day, the last Bill of the series referred to them—the Southwark and Vauxhall Water Bill—was proceeded with.

Mr. POPE, Q.C., Mr. BIDDER, Q.C., the Hon. A. LYTTELTON, and Mr. A. DU CANE appeared for the promoters. The Bill was opposed by the London County Council, represented by Mr. COHEN, Q.C., and Mr. FREEMAN; the Corporation of London, by Mr. LITTLER, Q.C., Mr. RIGG, and Mr. L. MONCKTON; the Conservators of the River Thames, by Mr. LITTLER, Q.C., and Mr. BAGGALLAY; the Corporation of Richmond and the Twickenham Local Board, by Mr. L. COWARD; and the Hampton Local Board, by Mr. PEMBROKE STEPHENS, Q.C., and Mr. COURTHOPE MUNROE. Petitions against the Bill were also presented by the Heston and Isleworth Local Board, the Middlesex County Council, the Sunbury Gas Consumers' Company, the Lambeth Vestry, and the Kent Water Company; but it was announced that these bodies had been settled with.

Mr. POPE, Q.C., in opening the case, said the questions involved in the Bill had already been before the Committee in the two previous Bills; and the objections on principle which applied to those cases applied also to this. The Bill was "to authorize the Southwark and Vauxhall Water Company to acquire lands, construct additional works, raise additional capital, and for other purposes;" the "other purposes" being of a minor character. The works proposed were a service reservoir, a double line of pipes in connection therewith, a double line of pipes at Hampton in connection with the filter-beds, a new storeage reservoir, and a storeage and a subsiding reservoir at Hampton. The necessity for these works would be fully explained by the Chairman of the Company. Whatever might have been the needs of the other Companies, the most necessitous one in London, in regard to storeage, was the Southwark and Vauxhall. At present they possessed storeage for only 1·8 days, or practically none at all. If they were to serve their district effectively, they must have storeage somewhere; and they had placed it in the immediate neighbourhood of the intake—thereby acquiescing in the decision of the Royal Commission, which pointed out that the storeage reservoirs ought to be as near as possible to the works of the Company. Dealing with the petitions against the Bill, Counsel said that of the Corporation of London related to the sinking fund clause, which would be discussed when the clauses applicable to the whole of the Companies came to be settled. The petition of the Hampton Local Board objected to the stopping up of a footpath, which was a private one, and to the site of the proposed engine and boiler shed, "inasmuch as the landing of coal, the throbbing of the engine, and the emission of steam and smoke would prove a great nuisance." It also protested against the laying down of a double line of pipes, which might interfere with the sewers; but he had no doubt this matter could be arranged. The petitions of the Richmond Corporation, the Heston and Isleworth and the Twickenham Local Boards, related mainly to the exemption which the Company sought from the double rating for the whole of the main through Richmond, to which the property within 100 yards of the River Thames was subject under the Richmond Footbridge, Sluices, Lock, and Slipway Act of 1890. As to the petition of the London County Council, everybody knew what their view was, and they were the only petitioners who raised the entire question on the Bill; but he would not at present deal with their objections in detail. The Thames Conservancy were, of course, largely interested in the original provisions of the Bill; but as the clause which authorized the Company to take more water from the Thames than they were doing at present had been struck out of the Bill, this point was no longer disputable. The petition complained that the Company had drawn water from the Thames considerably in excess of the limit of 24½ million gallons during each 24 hours, and had taken from lands adjoining the river large quantities of water which, but for such abstraction, would have formed part of the flow of the stream. He did not quite see how this matter could be dealt with in the Bill, even supposing the Company had been guilty of illegally taking water from the Thames. The Thames Conservancy Bill was under discussion before another Committee. That Bill made provision for the quantity of water that the Company were to be allowed to take; and before that Committee he would have to discuss how far that restriction was in the interests of the public or in those of the Conservancy itself.

The CHAIRMAN: Do you propose to take more than the 24½ million gallons?

Mr. POPE: Not under this Bill. I shall ask the Committee on the Thames Conservancy Bill to authorize more, because the Company really require it.

Mr. BRUNNER asked if this Committee would not have the power of putting in some measure of control.

Mr. POPE replied that he did not see how the Committee could put any limitation into the present Bill. The Company did not ask for increased powers; and the Committee would hardly seek to limit those they had at present.

Sir *H. E. Knight*, the Chairman of the Company, was then examined by the Hon. A. LYTTELTON. He said the Company was formed by amalgamation with the Southwark Company in 1845, when they were authorized to take water from the Thames for the supply of their district; and the question of the supply from the river was also dealt with again by Act of Parliament in 1852, when the intakes of the Company were removed to Hampton. The Company had done the best they could, with their available means, to purify the water; but, having regard to the opinions expressed by the Royal Commission, and the evidence of the Official Water Examiner and Dr. Frankland, they had come to the conclusion that further storeage reservoirs were necessary.

The CHAIRMAN said the Committee were pretty well convinced that storeage was a requisite thing. The question was as to the amount that was required, and whether the Company were going to unnecessary expenditure with respect to it. They all knew that, as regards

the ordinary consumption of water, unless it was stored and allowed to subside, it was repulsive to the eye and palate, whatever it might be to the digestive organs.

Witness, in further examination, stated that month after month the Water Examiner had called attention to the urgent necessity of storeage in the case of the Company. This did not mean that the water was impure when it went out for public use; its excellent quality having been maintained because the Company were very careful in their filtration. The site selected for the reservoir conformed to the three main principles laid down by the Royal Commission. First, it was as near as possible to the intake; secondly, the geological character of the ground was satisfactory, being the same as at Staines, which was recommended in Messrs. Hunter and Fraser's scheme; and, thirdly, it reduced the flow of the river at the latest possible moment. At Hampton, the clay was comparatively near the surface; the puddle walls would be put into the clay, and would provide a most effective and efficient storeage reservoir. By having the reservoir at Hampton instead of at Staines, they would save eight miles of conduit, which he regarded as an unnecessary expense; and he also considered the water at Hampton was purer, by reason of the entry of the River Wey, than it was at Staines. Another advantage was that the ground was at a lower level than at Staines, which would save unnecessary pumping. The storeage reservoir proposed to be constructed would have a capacity of 275 million gallons; and, with the other provisions to be made under the Bill, the Company would have a storeage for 16 days, instead of the 1·8 days as at present. They proposed to remove the Battersea filter-beds to land adjoining the existing beds at Hampton. He was certain they could not do with any less storeage than that now proposed. They would like to have had a great deal more; but they had limited the demands to a reasonable sum, on account of circumstances known to them all.

In cross-examination by Mr. COHEN as to the quantity of water the Company were entitled to draw from the Thames, witness said that, under the agreement with the Conservancy, they could take the 24½ million gallons; but, independently of this, under the statute of 1852, he maintained that they could draw any quantity they pleased. The agreement could not override the statute; and the statute specified that they could take all the water they wanted for the supply of the district without the consent of the Conservancy.

Mr. COHEN: It has never been contended by anybody that the Company have such a right.

The CHAIRMAN: I doubt very much whether you do not very often override a statute by an agreement. All we know of this Bill is that there is no further power than that which the Company already possess for taking water out of the Thames, whether by statute or by agreement.

Mr. COHEN: I will undertake to satisfy the Committee that they have no power at all, without the consent of the Conservancy, to take a single gallon of water more than they do at present.

The CHAIRMAN: I do not think you need go into that. Whatever their powers are, they do not alter them at all by any application to Parliament now.

In further cross-examination, witness stated that from the gravel by the side of the Thames they could easily get 15 million gallons a day of beautiful water, when the river was in flood and the water was unfit to take at all. They could also obtain a supply of from 10 to 15 million gallons from the other Water Companies who were not taking their maximum quantity; and from the well at Streatham, which would come into use at the end of the year, they would obtain a further supply of 3 million gallons a day. In taking the water from the gravel at the side of the Thames, he deemed that they were not drawing it from the river. It never was in the Thames; and therefore could not be taken from it. He was not aware that anybody had a right in underground water. The Company had been taking it for years, and would continue to take it until Parliament said they should not; and he did not think Parliament would say so.

The CHAIRMAN: I know, with these kinds of water rights, one gets into most difficult and complicated questions as to whether the water comes out of a stream or whether it does not.

In further cross-examination as to the well at Streatham, the witness said the matter had been fully inquired into by the Local Government Board, and a certificate given as to purity and value of the water. It had not yet been worked for purposes of business, but only experimentally. With the proposed works, they would have a reservoir capacity of 483 million gallons, which would carry them forward to 1901, or possibly a little longer. He denied that the scheme of Messrs. Hunter and Fraser was put before the Royal Commission with the approval of his Company, as they considered it a very undesirable project, on account of the money which would be wasted on the conduit.

Mr. LITTLER, in cross-examining witness, for the Thames Conservancy, as to the Company's powers of taking water from the Thames, read copious extracts from the agreements between the Conservancy Board and the Company, and also from the evidence laid before the Royal Commission; but the witness maintained that the agreements could not override the statute of 1852. Those agreements were, he said, merely made for pecuniary purposes, to give the Thames Conservancy money.

Cross-examined by Mr. RIGG, for the Corporation of London, witness stated that the additional capital to be raised under the Bill was £750,000; and he would have no objection to the insertion of a clause allocating the money to the particular works. The sum obtained from the abandonment of the Battersea works and the sale of surplus land would necessarily be put to capital account. He thought it very undesirable that the stock should be issued as a redeemable stock—different from all their other stocks, which were irredeemable.

In further cross-examination by Mr. COWARD with reference to the rating for Richmond Bridge, and by Mr. COURTHOPE MUNROE as to the Hampton sewers and the closing of the footpath, witness stated that the Company would be prepared to help the sewer authorities in regard to the provision that they might require for the laying of their sewers beneath the roads. The boiler-house and chimney, instead of being put up at "one of the prettiest spots in Hampton," was next to a slaughter-house, and within 50 yards of a large candle manufactory which stank terribly. There was not a decent house near it; and they had placed it purposely far away from the road, where it could not possibly do any injury.

Mr. *J. W. Restler*, M.Inst.C.E., the Engineer to the Company, examined by Mr. BIDDER, said they had been gradually extending their high-pressure system throughout the district. Principally in the lower portion of the district, there had grown up a considerable demand for supplies at high pressure, for model dwellings, lifts, fire supplies, and fire-mains; and to meet this, they had extended a special system of mains. For the lower district they pumped from Hampton to Battersea, and then supplied the water after filtering it. The middle district was served from Hampton by water pumped direct to the works at Nunhead, and delivered by gravitation. The high-level district was divided into two parts—the Camberwell, or eastern portion, being supplied from the upper reservoir at Nunhead; and the western portion at Wimbledon, and the high-level district at Wandsworth, being supplied from the special pumping-station at Wandsworth. Altogether, the Company had about 116,000 services. The average rate of filtration per square foot per hour was 1·59 gallons, which was a very high average, because at Battersea the rate was not equally distributed. There they had 11¼ acres of filters, and at Hampton 9¼ acres; the rate of filtration at Hampton being 2·03 gallons per square foot per hour. The necessity for further storeage accommodation had existed for some considerable time; the present amount—1·8 days' supply—being the lowest of any Water Company in London. In addition to the capital proposed to be raised by the Bill for works, the Company had available £160,000 under the 1891 Act, which was still unexpended, and £32,000 the value of land in hand, not including the land at Battersea, which would bring up the amount to £942,000. The storeage reservoir would cost £254,000; the subsiding reservoir, £52,000; the additional filters, £110,000; the service reservoir for the middle level district, £190,000; the line of pipes between the storeage reservoir at Hampton and the engine-house, £20,000; another line of pipes beween the Nunhead and Honor Oak reservoirs, £6100; and the engines for district works, £50,000. These estimates, with 10 per cent. for contingencies, amounted to £750,310. To this must be added the completion of the storeage reservoir now under construction at Hampton, £59,000; the balance of the Hampton filters, £17,000; buildings in course of erection at the Streatham well, £17,600; works for high-pressure service, £15,000; and expenditure on mains (seven years, at £10,000), £70,000. Adding 10 per cent. for contingencies, this further amounted to £196,459, or a grand total of £946,769. At present the water taken for the supply of the filters was admitted directly from the river on to the surface of the beds, which was very undesirable, and had been commented upon several times by Major-General Scott and the analysts. It was intended in future to dispense with this, and to give the water a preparatory subsiding before its admission to the filters. The reservoir at Honor Oak was required to provide against risk of accident to the trunk mains and machinery. At present the Company only had 18 million gallons stored in the Nunhead works, which was very little more than half a day's supply; and it was intended to make a reservoir there which, with the Nunhead works, would practically contain a three day's supply, and give the Company a margin to enable them to repair any accident that might happen to the trunk mains or to the engines. Not long ago they had an accident, which caused a great deal of inconvenience, from not being able to duplicate the system; and at the present time they had one engine that was only temporarily repaired, simply because they could not stop it long enough to make permanent repairs. They proposed to add to their district a small portion of the parish of Lewisham, which at present they were supplying without any legal power, and where neither the Kent nor the Lambeth Company had any mains. Both of these Companies were content that it should be added. It was impossible that the works now proposed would become unnecessary and useless in the event of an amalgamation of the Companies, as suggested by the London County Council, because none of the Companies, with the exception of the Chelsea, were up to the minimum of storeage and filtration, as advocated by the Royal Commission. The supply per head given by the Company was 31·32 gallons; and the price charged was the lowest of any of the London Companies, except the East London—being 5d. per 1000 gallons. The average was rather more than 6½d. As to the difficulty raised regarding the laying of the Hampton sewers, he was willing to have a clause inserted in the Bill reserving sufficient space for them to be laid.

Mr. RIGG asked the Committee to obtain a Speaker's order for the attendance of Mr. Allen Stoneham, the Official Auditor under the Metropolis Water Act of 1871. As an official, Mr. Stoneham declined to attend as a partisan by becoming the witness of either party.

The CHAIRMAN said that Mr. Stoneham should be directed to attend.

The Committee then adjourned till the following Tuesday.

Tuesday, May 1.

On the resumption of the proceedings to-day,

Sir *H. E. Knight*, recalled, expressed his desire to correct an error into which he had fallen in saying that the water charges of the Company were the lowest in London. He had since looked into the matter, and had found that the Chelsea, the Grand Junction, and the West Middlesex Companies' charges were lower than those of the Southwark and Vauxhall Company. He also supplied details of the debenture stock, and stated that it was proposed to consolidate the various stocks into a 4 per cent. stock. Referring to the question of rating at Richmond and Twickenham, he said that in Richmond they had 1700 yards of 30-inch main, and the same extent of 36-inch main; and in Twickenham, they had 4530 yards of 30-inch, and 4500 yards of 36-inch main. Within the 100 yards limit in Richmond, there were 102 yards of each size of main; and in Twickenham, 155 yards of each size. They never foresaw that the double rate would be inflicted upon them; and therefore they did not appear on the Richmond Bridge Bill. They received £17,749 14s. for the supply of water in bulk to Richmond in 1893; and there could be no increase in the value of the mains within the 100 yards limit. The Richmond Corporation could discontinue taking the Company's supply whenever they pleased; and they were, in fact, sinking wells to get water for themselves.

Mr. *J. W. Restler*, M.Inst.C.E., the Company's Engineer, was then cross-examined by Mr. BIDDER with reference to the well at Streatham.

He said the water stood at about 42 feet from the surface in its normal state; and when they had pumped at the rate of nearly 2 million gallons a day, the greatest depth to which they had been able to depress it had been 92 or 94 feet from the surface. The bulk of the water came from the Thanet sands immediately overlying the chalk. The boring passed through the chalk, the upper greensand, the gault, and the lower greensand, and finally terminated in the old red sandstone rocks at a depth of about 1140 feet from the surface. The well was 242 feet deep.

Cross-examined by Mr. COHEN, witness stated that, adopting the views of the Royal Commission, the necessary supply for the Company in 1901 would be 38,190,000 gallons. The bulk of the supply was always intended to be taken from the river.

Mr. COHEN: That is too indefinite. What do you expect to get from the river itself, independently of the gravel?

Witness said the proposed works would enable the Company to take the whole supply they required from the river, if necessity compelled; and it was his view that they had legal power to do so. As to the value of the site of the Battersea works, which they proposed to abandon when the new storeage came into operation, he could not say what it was, nor could he tell if its value was taken in the 1880 balance-sheet as £300,000.

Dr. *E. Frankland* was next examined by Mr. DU CANE regarding the quality of the water. He said he had on several occasions made extensive inspections of the Thames and its tributaries; and he had come to the conclusion that the best point for abstracting water for the purpose of supplying London was the site of the works at present in operation at Hampton, as the chemical quality of the water was better there than at any point below Lechlade. It contained a smaller proportion of organic nitrogen than at any other point in its course. The flow of a river through a considerable distance, especially if the water was not very deep, occasioned the destruction of immense numbers of bacteria in the water. It would therefore be likely that the Hampton site would, on this ground, be the best for abstracting the water—in fact, they could not go to a better place than Hampton for taking it. It had for many years been well known to him and others that the Southwark and Vauxhall Company were sadly deficient in storeage capacity; theirs being the lowest of any of the London Companies. Storeage and filtration were two of the most important things in connection with water supply. There was great bacterial advantage in storing, as was strikingly exhibited in the case of the East London Company's storeage, which he had investigated more minutely than that of any other Company. The water taken by that Company from the Lea sometimes contained as many as 56,000 living bacteria in a single cubic centimetre, or 20 drops, of water; but after 15 days' storeage, the number left never exceeded 2500, and sometimes fell as low as 400 microbes to the cubic centimetre. After this it went to the filter, and was further purified.

In answer to questions, witness said there were various theories as to how the bacteria were disposed of. They were supposed to fight one another; and there was considerable slaughter among them. But probably the most potent cause of their destruction was light. As a rule, all water contained fewer microbes in the summer, when there was more light, than it did in the winter. Another advantage of storeage was that it enabled the Company to exclude the flood water, and in this way to gain a considerable chemical advantage. A further advantage of storeage was that the grosser particles of suspended matter in the water subsided in the reservoirs; and this was a great relief to the filters. The filters did not require cleaning anything like so often, if there was ample storeage, as with insufficient storeage. The advantage of this was that the filter improved in cleansing qualities the longer it went without cleaning. A filter ought to be cleaned as seldom as possible, because for several days after cleaning it delivered water imperfectly purified, especially in regard to bacteria. Though the storeage and filtration capacity of the Southwark and Vauxhall Company was so deficient, they had never, during last year or this year, delivered a sample of turbid water. It had always been perfectly clear and transparent to the eye; but on several occasions it had contained far too many bacteria. They were now aiming at greater efficiency of filtration than was contemplated by the Act of Parliament, which only required the water to be clear and transparent to the eye; and they were now seeking to provide that the number of bacteria should not exceed 100 in a cubic centimetre. That this could be accomplished by sufficient storeage and good filtration was evidenced by the operations of the West Middlesex Company, but especially by those of the Chelsea Company, who had more than 14 days' storeage. These Companies delivered water which often did not contain more than 30 microbes in a cubic centimetre; and on one occasion—in February of last year—it was absolutely sterile, although at the intake the water contained 3000 or 4000 microbes per cubic centimetre. As to the proposals of the Company being sufficient to meet the recommendations of the Royal Commission, if he were to criticize them freely, he should say that they fell rather short of the powers for which they really ought to apply. He would like the Company to have storeage for 20, instead of 15 or 16 days. He ought to mention, as an important thing, that it had now become an established fact, in connection with sand filtration, that efficient sand filtration was a perfect safeguard against the admission of the cholera bacillus into a water supply; and it was extremely probable, although this had not been so rigidly demonstrated, that the typhoid bacillus would be arrested at the same time in the same way. He thought what the Company asked for was the minimum amount of storeage that ought to be conceded to them; and he believed it would be quite impossible for them to go on in their present condition, and supply good and wholesome and efficiently filtered water to their consumers. They must have more space, or they could not do it. Referring to the water from the Streatham well, he said he had reported upon it to the Local Government Board. The water had on every occasion been of a very high degree of organic purity; and in every respect, except that of turbidity, it was an excellent water for domestic supply. The Thanet sand, or at all events some very fine sand, came into the well along with the water, and was pumped up with it. Consequently, the Local Government Board had, he thought very properly, required that the water should be filtered before it was supplied; not that the suspended matter was noxious, but he thought all water supplied for drinking purposes ought to be clear and transparent, and not muddy in the slightest degree. The sand would not injure health; but as it was very fine, and did not subside rapidly, it might get to the consumer.

Cross-examined on behalf of the London County Council, witness remarked that he assumed the report of the Royal Commission would be acted upon, and that the Thames Valley would for some time to come be the source of water supply for London. He would prefer even now that the supply should be taken from the gravel, which was to some extent used for this purpose, and from deep wells and springs in the chalk and oolite of the Thames basin; but this would involve a very great additional expense. From the Thames and the Thames Valley, there was, in his opinion, an ample supply of water for London, even taking the expected rate of increase of population, for 100 years. It was a curious fact that the water drawn from the gravel was nearly sterile of bacteria; and therefore he thought it must have been stored for some time in the gravel. If the taking of water direct from the Thames were abandoned, and water were derived from the gravel by the side of the Thames, the necessity of any very large additional expenditure for the purpose of storeage and filtration might disappear to some extent. The supply from the gravel was uncertain; and at the works of the Southwark and Vauxhall Company, it varied between 3 and 13 millions in a day. He did not know whether they could rely upon always getting the proper quantity from the gravel without having a provision for storing it. The difficulties as affecting water taken from the Thames had diminished since the report of the Rivers Pollution Commission in 1874, as there was no bacterial investigation at that time. It was perhaps difficult to arrive at a perfectly satisfactory conclusion on that point. But still his analysis seemed to point to the circumstance that the sewage which was discharged into the Thames above the intakes of the Water Companies was better purified now than it used to be. At the time of the Rivers Pollution Commissioners' report, scarcely any sewage was purified before it went into the Thames, but was discharged in its crude state. In so far as the wholesomeness of the water was concerned, the difficulties had enormously diminished since 1874, because it had now been proved, as he had said, that, in the case of cholera poison, efficient sand filtration was a perfect safeguard against the passage of the cholera microbe into the filtered water.

In reply to the COMMITTEE, as to whether he considered a sand or a carbon filter more efficient for stopping microbes, witness said he had no doubt that a carbon filter, if in the form of blocks, or something very close-grained, would be equally efficient. But it would be very expensive; and it had not yet been proved to be efficient. Efficient sand filtration would, however, prevent the propagation of cholera. Deep wells were absolutely sterile of bacteria when the water came out of the water-bearing stratum; but they almost always received a few microbes afterwards in the pumping machinery. Light did not kill the bacteria in sand filtration, as that was a mechanical action. They had such a perfect filtration in passing water through (say) half a mile of chalk, that it arrested the bacteria; but, of course, this was a mechanical action.

Sir *F. J. Bramwell*, F.R.S., questioned by Mr. BIDDER, said he had examined the proposals in the Bill, and considered that the storeage proposed, in view of the quantity suggested by the Royal Commission, did not exceed, but fell far short of, what ought to be provided. The filtration, taking into account the intended removal of the Battersea works, was by no means excessive; and, to his mind, any prudent owner of the undertaking, be it a water company or a public authority, would, if it desired to do the best for the consumers of London, carry out the works now suggested. Having regard to the standard which had been indicated in the report of the Royal Commission to secure the purity of the water supply of the Metropolis, the Company were, in his opinion, not asking anything more than was necessary to attain this standard. As to the covered reservoir at Honor Oak, it appeared to him to be extremely desirable that the Company should have at that high elevation a storeage of filtered water ready for distribution in the event of a fractured main, and also preserving a pressure competent for the extinction of fires. As to the £50,000 asked for for engine power, they would need it for pumping into and out of these reservoirs.

Cross-examined by Mr. CRIPPS, witness said the storeage reservoir estimated to cost £254,000 was divided into two compartments; having a partition wall across it. It would require, speaking roughly, from three to four years to make the reservoir. Its construction would place the Company in a position to receive and deal with 24 millions of gallons of water a day from the Thames itself. He did not mean to say that the Company at present had power to take it; but he presumed the day would come when people would say it would not do for the Conservators of the Thames to play the part of the "dog in the manger" by making the Companies starve for want of water, while surplus water was going away to the sea. The works proposed were needed for the mere purpose of dealing properly with the present take; but if they were carried out, it would put the Company in the position of saying to those whom it concerned: "Why not, in periods when you have more water than you know what to do with, give it to us, for we have the means now of taking it?"

In reply to the COMMITTEE, witness said they were using Clark's process for softening water where they emptied the reservoirs daily. They had a floating take-off—a pipe with a floating perforated chamber about two feet below the surface, so as not to take any scum that there might be upon it—and this filled as the reservoir emptied. He did not think the works were more than were required for the present daily consumption. If, by a stroke of magic, they could get them tomorrow, it would be a good thing; but, having regard to the increase that there would be during the time the works were in course of execution, they would certainly not be more than was necessary.

Mr. COHEN, addressing the Committee on behalf of the London County Council, urged that it was contrary to public policy that the supply of a commodity necessary primarily for life and health should be left to be administered in order to increase the profits of trading Companies who did not, and could not, compete with one another. Under the Royal Commission, a permanent scheme had been recommended; and he asked the Committee to consider whether all the proposed works were necessary for the immediate future. If they were not, he asked the Committee to consider what portion of them

were—say, half of them—because, if more works than were essential were allowed, the public authority to which would ultimately be entrusted the task and burden of managing the water supply of the Metropolis in future, would have its hands fettered.

Counsel then addressed the Committee for the Corporation of London; urging that the Company should be limited to the necessities of the immediate future, so far as the issue of capital was concerned. The Committee were also addressed on the question of exemption from rating.

The CHAIRMAN said the Committee were of opinion that the preamble of the Bill was proved; but when they came to clauses, they might have to suggest that the amount of works proposed by the Bill was large, and might have to be modified. On this, however, they had not made up their minds, as it was a very important question; and they wished to have an opportunity of consulting on the point. In giving this decision, they did not wish to prejudice the question of the acquirement of the water supply of London by a competent water authority, without expressing any opinion at that moment as to what the water authority ought to be. The Committee were of opinion that the clause relating to the rating in Twickenham and Richmond ought to be struck out of the Bill.

Mr. L. COWARD, on behalf of the Richmond Corporation and the Twickenham Local Board, applied for costs against the Company.

The Committee declined to grant the application.

Wednesday, May 2.

THE SINKING FUND CLAUSE IN THE WATER BILLS.

On the Committee re-assembling to-day, the sinking fund clause was taken on the Company's Bill; it being understood that whatever form of clause was adopted should be made applicable to all the Bills before the Committee.

Mr. PEMBER brought up clause 17, which the promoters proposed to insert in the Bill, and explained at length the history and circumstances under which the sinking fund had been imposed upon the Companies. The clause ran as follows:—

From and after the expiration of three years from the issue from time to time of any debenture stock under the powers of this Act, there shall be carried to a sinking fund in each year such percentage on such amount of debenture stock, and any premiums received thereon, as shall be equal to the excess of the average percentage of the dividend or interest paid for that year on all the capital of the Company, whether share capital or borrowed, above the interest, together with an additional one per centum per annum added thereto for management on such debenture stock; such sinking fund to be held and applied by the Chamberlain of the City of London as trustee, for the purpose of purchasing and holding shares or stock of the Company, and of investing the dividends thereon, with a view to ultimately extinguishing the capital of the Company, or for such other purposes as Parliament may from time to time determine.

Mr. *G. P. Goldney*, the Remembrancer of the City of London, was examined by Mr. LITTLER on behalf of the City Corporation, and referred at length to the correspondence and discussion that had taken place in regard to the "cancellation" or "extinguishment" of the stock, and as to whether the stock placed to the sinking fund should bear dividend the same as the ordinary stock.

Mr. *Allen Stoneham* was also examined as to the manner in which the sinking fund had been dealt with since 1888.

At the close of his evidence,

The CHAIRMAN said the Committee thought it better to indicate to the parties the idea that was passing through their minds. They regarded the clause as a very important and very complicated public question; but they had pretty well made up their minds as to the lines on which the stock of 1894 would have to be issued, though it must not be looked upon as a final declaration. If, after consultation between then and the time the Committee met again after Whitsuntide, there were any grave objections to the course suggested by the Committee, they would hear Counsel upon it. They thought the moneys to be obtained for the purposes of the three Bills before them should be raised by auction and the issue of stock bearing not less than 3, or more than 3½ per cent. interest; and that the Water Companies, or their successors, should have the power, after the expiration of a given number of years (which the Committee left open at present), dating from Jan. 1, 1895, of redeeming such stock at par. They reserved also the consideration as to how far any sinking fund clauses should attach to the 1894 stock. They were of opinion that the clauses of 1886 and 1891 were unnecessarily complex in their drafting and in their operation. By adjourning until after Whitsuntide, they would give the promoters and opponents the opportunity of conferring; and the Committee especially suggested that they should consult the Local Government Board, with the view of endeavouring to assimilate for the future the action of the clauses of 1886 and 1891, and of making them more simple in their character and action. This would also afford them the opportunity of conferring on such clauses as might be required to carry out the opinion of the Committee with relation to the issue of 1894 stock on the lines already named. This was the course of action which seemed to the Committee to be the most simple, because they felt that it would give the Local Government Board the opportunity of being consulted (which they thought was very essential, as the Board had taken a great deal of interest in this matter), and that it would probably be a great public service if they could amalgamate the clauses of 1886 and 1891, though he did not at that moment see how it was to be done. They ought to run together, if possible.

The Committee then adjourned till the 28th inst.

Electric Lighting for Coventry.—Last Wednesday, Mr. F. H. Tulloch held an inquiry at Coventry into an application by the City Council for the sanction of the Local Government Board to the borrowing of £20,000 for electric lighting purposes. It was stated by the Town Clerk (Mr. Beard) that powers were granted to the Corporation to light the city with electricity in 1891. They were required to light certain streets within a given time; and it was proposed to do this at once out of the loan now asked for. The charge was to be 8d. per Board of Trade unit. There was no opposition.

MISCELLANEOUS NEWS.

THE COST OF MANUFACTURING SULPHATE OF AMMONIA.

In the JOURNAL for the 17th ult. (p. 712), a letter on the above subject appeared from a gentleman who has the management of a chemical factory. The writer had reason to question the accuracy of certain figures given in our columns on Feb. 2, 1892, representing the cost—amounting to £3 12s. 2d.—of making a ton of sulphate of ammonia; and he produced a schedule of expenses, based upon his own experience, totalling up to £5 7s. 1d. per ton. Of course, these figures were published in good faith; and we have been waiting for some confirmation or refutation of them. An esteemed correspondent, who, for many reasons, desires to conceal his identity, was so much struck with the items in the chemical manufacturer's schedule, that he has, like ourselves, been expecting some figures from others interested in the question. As these have not been furnished, he has sent us for publication a few at which he has arrived as a result of his own practice, accompanied by some explanatory remarks.

Taking the items in the order in which they stand on p. 713, our correspondent remarks, in regard to oil of vitriol, that his average price, under contract for twelve years, for chamber acid, is £1 9s., as against £2 given by the "Manager of a Chemical Factory." This gentleman puts down 2s. 6d. for purifiers for gas. This costs our correspondent nothing to get rid of; and he asks: "Why not make acid of it?" Then the extraction and removal of lime mud cost "Manager" 2s. This our correspondent considers is double what it should be; and he puts the amount at 1s. On the item of tools and light, put at 1s. 6d., our correspondent remarks that tools would be a very small amount; and he thinks it is not fair to charge at per ton the light required in a small works, as twice the quantity of sulphate could be made for the sum stated. As to bags, for which 3s. 4d. is charged, our correspondent says that buyers in London always provide them; and he points out that they are included in our quotations. With respect to the cost of superintendence and clerical work, amounting together to 8s. 6d., our correspondent thinks this is "absurdly high," for on a make of 2500 tons it would come to £1062 10s. He puts the figure at 3s. 6d. Depreciation and repairs, 12s. 6d., would, he says, write off the cost of the plant in two years. His figure is 5s. 6d. Fuel, 3s. 9d., is a trifle more than our correspondent's figure, which is 3s. Then as to lime, 2s. 9d., he says this either costs "Manager" too much, or more is used than is necessary. His own figure is 1s. 5d. Labour, again, is high—viz., 12s. 6d., as compared with 7s. Our correspondent justifies his figure by saying that four men can easily make 5 tons of sulphate in 24 hours. Packing costs him about the same as "Manager;" and he allows the 2s. 6d. put down for contingencies. Cartage, 1s., he will not allow, as he says this is paid for by buyers in London quotations. The same remark applies to carriage and f.o.b. charges, 11s. 6d.

We have now dealt with each item; and, for convenience of comparison, we give them side by side:—

	Manager's Figures.	Our Correspondent's Figures.
Oil of vitriol	£2 0 0	£1 9 0
Purifiers for gas	0 2 6	..
Extraction and removal of lime mud	0 2 0	0 1 0
Tools and light	0 1 6	0 1 6
Bags	0 3 4	..
Water	0 1 3	0 1 3
Wages of superintendence	0 3 6	0 3 6
Clerical work at office	0 5 0	
Depreciation and repairs	0 12 6	0 5 6
Fuel	0 3 9	0 3 0
Lime	0 2 9	0 1 5
Labour	0 12 6	0 7 0
Packing	0 1 6	0 1 6
Contingencies	0 2 6	0 2 6
Cartage	0 1 0	..
Carriage and f.o.b. charges	0 11 6	..
Total cost	£5 7 1	£2 17 2

We have only to add that our correspondent, in submitting his figures, says he has put them rather higher than they actually work out in practice, as he does not wish to make them look too good. He points out that "Manager" charges 3½ per cent. discount off the price of sulphate, whereas our quotations are—or rather the London price is—on a basis of 25½ per cent. of ammonia, less only 1 per cent. commission. No account has been taken of rent and taxes; but 2s. per ton should cover these. In questions such as the one here dealt with, it is eminently desirable that all parties should be heard; and therefore we shall be pleased to have the views of other readers who are specially interested in the subject.

DR. S. RIDEAL ON LONDON FOGS.

Last Tuesday evening, Dr. Samuel Rideal, Lecturer on Chemistry at St. George's Hospital, read to the members of the Sidcup Literary and Scientific Society a paper entitled "London Fogs: Their Cause, Constitution, Effect, and Possible Remedies." The author explained at the outset that London fogs are of two kinds—those in which the foggy particles tend to fall, and those in which they float about horizontally; the latter being by far the more injurious. He then went on to say that during times of fog the air is charged with several matters, notably carbonic acid, ammonia, and sulphur compounds. Carbonic acid is present to three or four times the extent that it is on a fine day; the reason for this being that while the air is full of moisture, the carbonic acid cannot be diffused, and so it accumulates. The sulphur compounds are present to about twice the extent compared with normal conditions; the cause being the retention of the gases resulting from coal consumption. It is estimated that the value of "recoverable" gaseous products—such as ammonia, &c.—which

are now wasted in the air, and which contribute to fog, is, in London alone, £3,000,000 a year; while damage to property is put down at £2,000,000 per annum, to say nothing of the fact that one foggy day costs Londoners £3125 for extra gas alone. Dr. Rideal said that to remedy the evil was admittedly a very difficult matter. In his opinion, the only way to get rid of fog was to do away with the present method of burning coal. The use of the electric light would be a deterrent to fog; and the burning of anthracite would also assist in a large degree, if it were employed for heating purposes. The illegality of using any fuel which gave forth smoke containing the properties of coal smoke might, he thought, be more stringently enforced; and again there was the suggestion to convert coal into gas at the pit's mouth, and supply the great centres with the gas by means of large pipes direct. It was calculated that to lay down such pipes to London from the principal coal-fields of the country would be £10,000,000; but if to the £3,000,000 loss he had already indicated there were added £1,500,000, the present cost of coal carriage, it would be seen that the outlay would be saved in two years. Another proposal was to generate, by means of the coal at the pit, sufficient electric energy for all lighting purposes. A discussion followed the paper, during which the suggestion to generate gas at the coal-fields was very adversely criticized. Several members were of the opinion that a more effective way of dealing with the difficulty would be by increasing the consumption of gas, to the corresponding displacement of coal fuel, for heating and cooking purposes; arguing that this would not only be more economical to the consumer, but also very beneficial to the community at large, as, by the conversion of coal into gas, many of the fog-producing properties were removed. The usual complimentary votes closed the proceedings.

WIGAN CORPORATION GAS SUPPLY.

Annual Report.

The report of the Engineer of the Wigan Corporation Gas-Works (Mr. Jos. Timmins) upon the operations of the year ending March 31 last is a somewhat lengthy but interesting document. It commences by giving information as to the alterations which are being executed at the works. He says that the eastern block of retort-benches has been completed, and is now ready to receive the retorts. These will consist of ten through benches of "sevens," representing 140 mouthpieces, with a carbonizing capacity of 80 tons of coal, providing 890,000 cubic feet of gas per diem; thus raising the daily maximum producing power of the works from 1,612,000 cubic feet to 2,508,000 cubic feet. Two 24-inch steel foul mains, with the necessary valves, connections, and ramifications, have been fixed; and two new purifiers, each 30 ft. by 20 ft. by 5 ft. 6 in., with the necessary pipes, valves, connections, and lifting apparatus, have been constructed, and brought into use. The old gasholder tank has been covered over with compound steel girders and corrugated steel plates, for the purpose of converting it into a tar and ammoniacal liquor storeage tank, the capacity of which represents about one-and-a-half years' production of tar, &c. About one-half of the covering is being paved with setts, for the purpose of forming a revivifying-floor for the purifying material. The railways and sidings are also now being laid down on a permanent plan. Some references to the maintenance of the works follow, after which Mr. Timmins states that the average illuminating power of the gas during the twelve months was 18·46 candles, and that at the end of the year there were 7489 consumers on the register; being an increase of 392. Satisfactory progress, he mentions, is also being made in the use of gas cooking-stoves. On March 31 last, there were on hire 557 stoves, which is an increase of 350 in two years. Respecting the working results, the quantity of coal and cannel carbonized was 25,734 tons, which is a decrease of 664 tons; while the gas made was 296,171,000 cubic feet, a reduction of 4,948,000 feet. The gas sold as per rental was 278,988,000 cubic feet, which is a decline of 7,980,000 cubic feet. This Mr. Timmins accounts for by the supply having been restricted by a reduced pressure, and by a large number of public lamps having been "closed down" in consequence of the difficulty in obtaining coal during the stoppage. The mixture of coal and cannel carbonized has cost about 7¾d. more per ton than last year, although contracts were made at much lower rates; and this was owing to the dispute in the coal trade. The extra cost on 25,734 tons represents £777. The gross profits for the year were £18,412, as compared with £17,783 in 1892-3; while the net profits were £4844, as against £5997. The decrease in the profits is the result of several causes—viz., the three charges under the heads of "Interest on loans," "Bankers' interest and commission," and "Sinking fund account," in which is shown an increase, as compared with the preceding year, representing 1s. 11½d. per ton of coal and cannel carbonized, which, on 25,734 tons, amounts to £2519. Secondly, there is the amount of £600 transferred from capital to revenue account, disallowed by the Local Government Board when the application was made for further borrowing powers. Thirdly, a transfer of £800, representing gas cooking-stoves, from capital to revenue account. Fourthly, the extra sum paid for coal during the miners' dispute over and above contract prices, amounting to about £1500. Then there is a loss resulting from what it is reasonable to assume would have been the increase in the consumption, as compared with the preceding year—viz., 11 million cubic feet, or 4 per cent. on last year's sales. This, with the decrease, makes the total loss 19 millions; representing a money value of £1341. The revenue account for the year has, therefore, been affected in the aggregate to the amount of £6761. The leakage during the year was 5·09 per cent., as compared with 4·08 per cent. in 1892-3. The report concludes with a number of figures as to the lengths of mains laid within and without the borough and as to the consumption of gas in the various districts supplied.

At the meeting of the County Borough Council last Wednesday week, Mr. C. B. Holmes, in moving the adoption of the minutes of the Gas Committee, called attention to the principal points in the above report. One feature upon which he specially remarked was that, although the quantity of gas sold was practically 8 million cubic feet less than in the previous year, yet the gross profits were larger; and this at a time when prices of residual products were ruling lower than formerly. Still the amount proposed to be handed over to the relief of the general district rate was considerably less. This was occasioned through the increased payment to the sinking fund and other charges including bank interest, commission, &c., amounting to about £3600. The sum the Committee proposed to hand over to the relief of the rates was £4500, although the actual net profits amounted to £4844. He also referred to a proposal to establish a reserve fund; their intention being to retain one-tenth of the net profits each successive year. He concluded his remarks by expressing a hope that the Council might be enabled to again reduce the price of gas to that ruling last year at the close of the current financial year. It was resolved to postpone discussion on the report.

LINCOLN CORPORATION GAS DEPARTMENT.

Annual Financial Statement.

At the last Meeting of the Lincoln City Council, Mr. W. T. Page, jun., made his annual statement respecting the results of the working of the Gas Department. He said that during the past twelve months they had not sold quite so much gas, nor made such a large amount of profit; but having regard to the late coal strike, and the fact that the coal they were able to secure was not of such good quality as that which they obtained under contract, they had, he believed, every reason to be satisfied with the result. He should say they were probably almost unique in the history of gas undertakings in having reduced the price of gas in the middle of the coal strike from 2s. 6d. to 2s. 4d. per 1000 cubic feet, as from Sept. 29. That they were able to take this step was extremely satisfactory to the Committee. The cost of the strike to the Corporation was something like £2250—that was to say, they had to go into the open market, and purchase 5400 tons of coal at the best prices obtainable; and, personally, he was very grateful to the Committee for the confidence they had shown in him, in empowering him to make those purchases as and when he chose, and exactly at what price he liked. The result was that their Engineer (Mr. J. Carter) was enabled to effect contracts at a price considerably less than would have been obtained had they been obliged to go through the ordinary procedure. The cost of the coal (which was procured at a price of less than £1 a ton) compared very favourably with the high rates paid by other persons. The loss of £2250 was reduced by the extra price which they were enabled to obtain for coke—viz., £900, leaving the net cost of the strike at £1350. This was a very substantial sum to lose; but he believed it was the minimum possible under the circumstances. In addition to this, the reduction in the price of gas, so far as the Committee were concerned, had entailed a loss of £950, to which extent the consumers had benefited. Yet, notwithstanding those adverse circumstances, they had been able to pay interest on their capital and sinking fund to the extent of £1950 odd; and they ended with a surplus of £597. They started the year with a balance of £600 to the credit of the profit and loss account; and as they finished practically with another £600, they were able to carry to the current profit and loss account something like £1200. Of the reserve fund, which stood now at £17,600, £10,000 was in Bank stock and Corporation stock; and the other £7600 was the working capital of the concern. But for the strike, probably their income would have been greater, because they had to ask the consumers to meet them by accepting a reduced pressure—a course which enabled the Committee to husband the supplies of coal. On one or two occasions, they were within three-quarters of an hour of being cleared out of gas; but when people went to bed, they knew nothing of the danger they had been in half-an-hour previously of being without a supply. In addition to this, the quality of the gas during those months was not all they should have liked, because they had to buy coal not always of the same character that they obtained under the ordinary contracts. Subject to those slight inconveniences, they did all they could to accommodate the consumers. One thing he had done on behalf of the Committee was to enter into an arrangement with a large colliery company to supply 3000 odd tons of coal between June 30 and Sept. 30 at a stipulated contract price. If the price of coal was lowered, this might be against them; but, on the other hand, if it increased in price, it would be in their favour. As far as he could see, the present prospect indicated that the contract would be in their favour. The minutes of the Committee were adopted.

BRADFORD CORPORATION GAS AND ELECTRICITY SUPPLY.

Proposed Oil-Gas Experiment—Electric Light Scheme for Out-Districts.

At the Meeting of the Bradford County Borough Council last Tuesday, Alderman Moulson moved the adoption of the minutes of the Gas and Electricity Supply Committee, which included a resolution accepting an offer by Mr. Isaac Smith respecting an experiment in making gas from oil, and resolutions recommending the issue of a circular to residents of the districts of Frizinghall, Manningham, and Heaton, which are not within the area of the gas supply of the Corporation, to ascertain their wishes with regard to supplying such districts with electricity, and also authorizing the Electrical Engineer in the meantime to prepare an estimate of the cost of the suggested works. Mr. Dixon inquired when the Chairman would call together the Sub-Committee who had been dealing with the Huddersfield and St. Helens systems of oil-gas making. The Sub-Committee had been to a great deal of trouble in the matter, and they should be called together to state the result of their labours. The Committee had agreed to give the system advocated by Mr. Isaac Smith and those who were associated with him a trial; but if the test were to be of real practical value, it must be worked alongside some other. The Huddersfield Corporation claimed to be able to save £10,000 a year by the system they had adopted; and the St. Helens plan was alleged to save 33 per cent. of the cannel used. If this was well founded, it meant that the Bradford Corporation, who used £28,000 worth of cannel per annum, would be able to save £10,000 a year. He thought that Mr. Smith's and the St. Helens system could be tried side by side, at very slight cost; and then there would be a fair opportunity of seeing which would be the better

one to adopt. Mr. Smith's system had, he understood, already been tried at Birmingham, and had there proved a failure. Alderman F. Priestman invitedthe Chairman to state what Mr. Smith's offer was; and if the Committee were quite satisfied that his plan was better than those in use at St. Helens and Huddersfield. He assumed that they had grounds for delay, or otherwise they would have already tried the oxy-oil gas, which they had thought to be the best thing in the market. Mr. Jowett moved an amendment to the resolution with regard to circularizing the inhabitants of Frizinghall, Manningham, and Heaton, so as to make the scheme include Allerton. The amendment was seconded; and, after some further discussion, Alderman Moulson replied. With regard to the trial of the St. Helens oil-gas plant, he said the Committee felt they would be scarcely warranted in undertaking it until they saw the results which were obtained by the system elsewhere. He did not know of any place, except St. Helens, where the system was in operation at present. Alderman Moulson afterwards said that an arrangement, which the Sub-Committee considered reasonable, had been made with Mr. Smith with regard to carrying out an experiment in making "gas from oxy-oil." As to the Sub-Committee being called together to give the result of their labours, the cause of the delay was that an arrangement had been made for visiting Halifax, and inspecting the destructor works and oil plant there. As to Alderman Priestman's question, Mr. Smith's system had not been tried sufficiently to enable the Committee to know anything about it. Mr. Jowett withdrew his amendment; and the minutes were adopted.

PENRITH LOCAL BOARD GAS SUPPLY.

Reduction in the Price of Gas.

At the last Meeting of the Penrith Local Board, the Chairman (Mr. B. Sweeten) presented the accounts of the Gas Committee for the year ending March 25 last. They showed a net profit of £473 19s.; and the Committee recommended that the price of gas should be reduced to 2s. 6d. per 1000 cubic feet as from the 1st of July next. In moving the adoption of the minutes, the Chairman gave a few interesting particulars in regard to the gas undertaking (which was acquired by the Board in 1878), from the latter end of 1892, when considerable additions were made to the plant. He stated that the holder then erected on Mr. Gadd's spiral system had worked remarkably well, and had stood the strain of succeeding gales without being affected in the slightest degree. The new scrubber, too, had been most efficient; and their engine power had been able to deal with it quite easily. The last new plant—that for the manufacture of sulphate of ammonia—had been in use for two months, and had turned out a salt of excellent colour, and having a very high percentage of ammonia, the bulk of which had been sold at a remunerative figure. Referring to the proposed reduction in price, he said the members might ask how it was that, while a large number of companies and corporations had found it necessary to raise their charges, they in Penrith were able to make so substantial a reduction as 4d. per 1000 cubic feet. The answer was that they were exceedingly fortunate in placing their coal contracts. Going into details, he showed how they proposed to meet the reduction, which he thought would lead to increased consumption of gas; and he then went on to say that the policy of the Committee, ever since he had been connected with it, had not been to relieve the rates at the expense of the gas consumers, but to charge the latter the lowest possible price. Had the figure been maintained at what it was when the Board acquired the works—4s. 5d. per 1000 cubic feet—they could every year have relieved the rates by from £1000 to £2000 per annum, and this year only a 7d. rate need have been levied. But would the gas consumers have been content to pay nearly the whole rates of the town? By the amounts named they had been financially relieved; and really by more, for meter-rents were reduced 25 per cent., at a loss to the revenue of upwards of £50, and the illuminating power had been increased from 14 to 18 candles. If they took it that the former standard was equal to 2s. 4d. per 1000 cubic feet, the latter would have a value of 3s.; and this difference would at present mean exactly £1000 a year. In 1880 the quantity of gas unaccounted for was 30 per cent., which meant that out of every £1000 worth of gas made, £300 worth was lost. The loss was now only 6 per cent., or £60 worth per £1000. Penrith led the van in the adoption of the "penny-in-the-slot" system, which, he was glad to say, was very popular, had proved a great boon to small consumers, and increased the consumption by more than half a million cubic feet. Cookers and fires, too, might come into more general use; so also might gas-engines, which could be run at from ⅜d. to 1d. per horse power per hour. Mr. Sarginson seconded the motion; and it was carried.

The Purchase of the Barry and Cadoxton Gas and Water Works by the Local Board.—In the estimates for the next half year presented by the Finance Committee to the Barry and Cadoxton Local Board last Friday week was an item of £2250, which was allowed to cover the expenses in connection with the gas and water works. Several members desiring an explanation of this sum, Mr. Thomas, the Chairman of the Parliamentary Committee, who have had the control of the purchase of the concerns, stated that, by the Act which gave the Board the power to purchase, they were compelled to pay the Company from the 1st of January last to the time when they completed the purchase at the rate of 5 per cent.; the Company carrying on the business at this guaranteed profit on behalf of the Board. They could have completed the purchase by borrowing the £160,000 needed in January. But they found it in the interests of the ratepayers to let the Company carry on the works, even though they had to contribute what appeared to be a large portion of the 5 per cent. profit; and this would be seen shortly when they would report to the Board as to the negotiations for the borrowing of the money which could only be obtained earlier in the year at a much greater interest than now. At a later stage of the proceedings, a mortgage deed was signed in which the district fund and general district rate and the revenue of the gas and water undertaking were pledged to the London and Provincial Bank for the loan of £29,929 required for the gas and water works.

THE ALLEGED "IRREGULARITIES" AT THE SOUTHPORT CORPORATION GAS-WORKS.

What are termed the "gas-works irregularities" at Southport are causing a great deal of excitement in the town. The local press teems with references to, and correspondence on the matter; but as yet, so far as we can judge, no one outside the Gas Committee really possesses any definite information as to the nature of the "irregularities." A memorial on the subject, bearing the signatures of 103 individuals, has been addressed to the Mayor (Alderman Wood, M.D.); and, at last Tuesday's meeting of the Council, he reported its receipt, and stated that he had presented it to the Gas Committee, and that it was being dealt with by that body and the Finance Committee combined. This statement opened the way for a discussion as to the proper mode of procedure in considering a memorial of this kind. Among the foremost speakers was Alderman Griffiths, who declared that he had seen nothing yet in the history of Southport, particularly in the history of the gas estate, to give him a moment's alarm; and why there was so much irregular procedure in this matter he was at a loss to understand. He moved—"That inasmuch as the petition has been already received and considered by the Committee of the Corporation, it is inexpedient for the Council to again receive such petition." The matter, he pointed out, was on the minutes, and subject to discussion when they reached the proceedings of the Committee. He did not think that they, as representatives of the people, should allow the interference of anyone outside. The discussion at this stage ended by the members deciding that the petition should be considered along with the minutes of the Gas and Joint Committees.

Another matter of local interest occupied the Council for a time, after which the Mayor stated that, before coming to the meeting, he had received a letter from Mr. Robson, a member of the Council, as follows: "I beg to give you notice of my intention to move a resolution at the meeting of the Council to-night—'That proceedings be taken against William Booth for the embezzlement of two sums of money belonging to the Corporation, one of which he has admitted to have taken.'" The Mayor, continuing, said that they should have had three days' notice of this special resolution, which ought to have been printed on the minutes; but he should like to take the sense of the Council as to whether they would allow the ordinary notice to pass, and the resolution to be put then and there. Alderman Griffiths was again to the front; remarking that he could not but feel the letter had no right to have been read at the meeting. The matter had been discussed in Committee that afternoon, and Mr. Robson had lost his resolution; but it would have come before the Council, in the ordinary course of business, at the next monthly meeting. The speaker became very warm in his language, and accused Mr. Robson of always being in a hurry when there was any "washing of dirty linen" to be done. He could at any time, with the necessary support, have got a special meeting of the Council within three days. Mr. Threlfall appealed to the Chairman of the Committee to put the facts before the public. Other members also urged that the rules of the Council should be observed; and then Mr. Holland said he had no sympathy with the way in which Mr. Robson had brought the matter forward. There was, however, an important point in connection with it—viz., What would have been the action of the Committee had they found a working man guilty of embezzlement—a man who was not the son of the Gas Manager? He pointed out that there were a number of Magistrates on the Gas Committee; and he thought Magistrates above all other gentlemen should know their duty. Alderman Fisher inquired why they could not have a special meeting to discuss this "important" embezzlement. They had actually found out already the "enormous" sum of £2 6s. 3d. Mr. Hough interjected the remark that "there are thousands of pounds to come out yet." To this Alderman Fisher replied: "We have not found it out yet but we want to find it out if there is anything." Further argument between members ensued; but the Mayor wound up the matter with the observation that it appeared the letter could not be discussed that night, and other business was therefore proceeded with.

Later on, the adoption of the minutes of the Gas Committee was moved by Alderman Hacking, and seconded by Mr. Hesford; and the motion was followed by another animated and protracted discussion. An amendment was proposed by Mr. Hulme to the effect that, as it had been suggested that the Gas and Finance Committees were too small in numbers for inquiring into the irregularities, the General Purposes Committee, consisting of the whole of the members of the Council, should conduct the inquiry, and that they should be called together at the earliest convenience by the Mayor. It was incidentally intimated by the Town Clerk that the inquiry would be a public one. Mr. Boocock, who seconded the amendment, said it was not in the interests of Southport that all this bother was being made. It appeared to him at most that a poor man had got into a somewhat irregular manner through the laxity of the Gas Committee. He had said it before, and he said it again, that the man had had too much work to do. The Committee had known it; and yet they had not given him the proper and efficient help which a man in his position ought to have. For this reason, he contended that the Committee ought to take a share of the responsibility, whatever the irregularities might have been. Mr. Holland drew attention to the following paragraph in the minutes: "The Borough Surveyor presented a report, in which he stated that the concrete foundation under the new chimney had cracked, and recommended that the said chimney should be taken down and rebuilt. Resolved—That the opinion of an expert in chimney building be obtained, and that he be desired to advise whether it would be safe to leave the present chimney standing, and, if so, what would require to be done to increase its stability, and, if not, what the best position would be for a new chimney, and to submit a design therefor." He said he thought it would be utterly useless to take an expert's opinion, inasmuch as sufficient was known, or ought to be known, by the Committee to satisfy them that it would be improbable, if not impossible, for the chimney to stand. He had in his hand a letter which, with his Worship's permission, he would read. It was signed by a workman who had been engaged on the chimney from the commencement; and

if the assertions contained in it were true, there had not only been irregularities from a financial point of view, but also gross mismanagement as regarded the work at the gas-works. On the suggestion of Alderman Griffiths, Mr. Holland said he was quite willing that the charges contained in the letter should form part of the inquiry. Mr. Isherwood stated that up to the present time not a single charge could be made against the Gas Manager (Mr. J. Booth), who so far was a badly used man. It was absurd for Mr. Holland to throw out insinuations in such a manner against the Manager and members who had grown grey in the service of the town. Alderman Griffiths also declared that the business of the Corporation had been carried on with less than a tithe of the loss sustained by a private tradesman. The books at Crowlands and Eastbank Street had been honestly kept, so far as the ratepayers were concerned; but those at the latter place had not been kept on the best system. In the course of a few remarks, the Mayor mentioned that, in accordance with a resolution passed at the last meeting of the Council, the balance-sheet of the moneys irregularly received and paid by the Gas Manager had been carefully examined by the Auditors; and the result was practically that they were where they were. Mr. Threlfall admitted that all his investigations went to show that, whatever faults the Gas Manager had committed, he had not been personally dishonest. He believed he had been simply guilty of irregularities; and he should have something to say in regard to the question of mismanagement. Mr. Hulme's amendment was then carried; and, with this alteration, the minutes were adopted.

IPSWICH CORPORATION WATER DEPARTMENT.

Annual Accounts.

Mr. D. Ford Goddard, J.P., as Chairman of the Water Committee, submitted their financial statement for the year ending March 25 last, at the meeting of the Ipswich Town Council last Wednesday. The accounts showed that the water-rental for the twelve months amounted to £12,173; and the sundry receipts to £368—making a total of £12,536. The expenditure totalled to £3884; leaving a balance of £8652. To this was added the balance from the six months' revenue account to March 25, 1893, £1561, and the rate-in-aid for the year ended March 25 last, £1100; making a total of £11,313. This was accounted for: By balance to consolidated loans fund account, £6509; and by balance, £4804. In the course of his remarks, Mr. Goddard said he intimated, in originally introducing this question, three benefits which were likely to be derived from the acquirement of the water undertaking by the town. He pointed out first that the water-works would become a source of revenue to the town; and from the accounts laid before the Council that morning, it would be seen that this would shortly be an assured fact. The undertaking was now in a position, not only to pay its way, but to yield something over as profit. His second point was that the purchase of the undertaking would serve to consolidate the loans of the borough; and this was a very necessary thing to do. In a certain degree, this also had come about, seeing that, in addition to the loan effected for the purposes of the water-works, other loans had been obtained under the scheme to the extent of £15,000, which would otherwise have been placed in different ways. He also intimated that there would be a considerable saving in the collection of the water-rate; and this had also come about. He estimated that the working expenses of the undertaking of the Corporation would be £4000 a year. The Council would see they had worked out at £3884. He also estimated the net income at £7400; and it had actually realized a balance of £8652. They had obtained this profit by steadily and carefully reducing the waste of water. In the year just terminated, they had pumped 67,076,000 gallons of water less than were pumped within the last year's working of the Company. The Committee had pumped 259,040,000 gallons; the Company, during their last year, pumped 326,801,000 gallons. This represented a saving of 20·7 per cent. in the amount pumped. There was thus a saving in cost in several ways. There was a saving in the fuel used for working the engine in pumping; time was saved; and there was a saving of wear and tear. This was the result of a thoroughly complete system of inspection. During the inspection, they had discovered about 2200 defective fittings, which had allowed the very serious waste of water. The waste had not only been discovered, but rectified. During the time the Committee had had possession of the undertaking, they had connected over 300 new services. They had also increased and improved the supply by laying 3½ miles of new mains. With regard to the current year, he might say that, supposing they made the same profit of £8652 (he took no credit for increased demands), they would, without any aid from the rates, be able to pay all their demands—of expenses and interest and sinking fund, and would have £500 to the good. A brief discussion followed, in the course of which two or three of the members congratulated the Water Committee on the success which had attended their management of the undertaking.

SHEFFIELD CORPORATION WATER SUPPLY.

The Annual Accounts.

A general statement of the accounts of the Sheffield Corporation Water Department for the year ending March 25 last has been issued by the Manager (Mr. W. Terrey). He prefaces the accounts by saying that there were fears that the season of depression through which trade has passed, accentuated as it was by the dispute in the coal trade, might materially affect the income, at least for trade purposes; but the period of drought which continued to the end of the year to a large extent counteracted the effect of the depression. On the whole, the results of the working may be taken to be very satisfactory. It is also matter for congratulation that, notwithstanding the long and severe drought, the water supply never failed for one hour; and the undertaking was able to meet every demand made upon it, both for trade and domestic purposes. With regard to the accounts, it is stated that the capital expenditure to March 25, 1893, amounted to £2,166,568; and the outlay during the past year has been as follows: Proportion of discounts and expenses of raising stock, £6809; costs, &c., *re* completion of land purchases, £39; completion of reservoirs and works, £258; extension of pipes and new meters, £9024; and Damflask wing trench, £11,204—making the total capital expenditure on March 25 last £2,193,903. As to the revenue account, the total income derived from water-rates for domestic and trade purposes during the year amounts to £97,782, as against £96,634 in the previous year; showing an increase of £1210 from water supplied for domestic purposes, and a decrease of £63 from that for trade purposes by meter—a net increase of £1147. The receipts from meter-rents, house, land, and mill rents, and plumbing work totals to £4981; making the income from all sources £102,763, which is an increase of £1084 over the previous year. On the opposite side of the account, the expenses of maintenance and management amount to £19,682. Adding the balance of parliamentary expenses *re* Sheffield Corporation (Water) Bill, 1893, £251, makes the total working expenses £19,934—showing an increase of £558 as compared with 1892–3. The net revenue was £82,829, on which are the following charges—viz., annuities £55,431; and interest on debentures, Corporation stock, &c., £19,424—making together £74,855, which is an increased charge of £278, and leaves a net profit on the working of £7973, as against £7725 in the preceding year. The sixth annual instalment set aside out of revenue for the redemption of annuities and the extinction of the loan indebtedness amounts to £6101; leaving a surplus for the year of £1872. The accumulated deficiency account shows that the total deficiency on March 25, 1893, amounted to £3621. Deducting therefrom the surplus on the operations of the past year (£1872) makes the present deficit £1749. Taking a general view of the working of the undertaking since it became the property of the Corporation, it is satisfactory to notice that, without any subsidy from the rates or other income of the Corporation, the ordinary income has been sufficient to discharge all the usual obligations against revenue, including the payment of annuities and interest on loans, and to provide the annual instalments to the sinking fund (amounting to the total sum of £38,040), and also to bear the following important additional charges: (1) Proportion of salaries and interest on unproductive works previously charged to capital account, £18,182; (2) increased rates and taxes settled by agreement, £9174; (3) cost of special treatment of the Redmires water, £1249; (4) costs and expenses of obtaining the Sheffield Corporation (Water) Act, 1893, relating to the additional 25 per cent. water-rates, £452—making the amount of extra charges paid out of revenue since the transfer, £29,057. The number of houses supplied with water is 73,471; being an increase during the year of 1175. There are 2784 water-meters now in use, as against 2644 in the previous year.

In moving the adoption of the minutes of the Water Committee at the meeting of the City Council last Wednesday, Alderman Gainsford, referring to the accounts, said that, as far as they went, they were very satisfactory. The water undertaking was not, however, in such a flourishing condition that it could bear increased charges. It was only saved from a reduced profit last year by the extraordinary drought. Trade dislocation led to the stoppage of large works; and the profits of the concern would have been seriously lessened but for the extreme drought during the summer, which caused many persons to come for supplies which they could not otherwise get. During the last three months of the financial year, there had been a serious falling off in the meter consumption—a reduction which he was afraid, unless made up during the remainder of the year, would seriously tell on the profits. The Corporation and the town had every reason to be satisfied with what had occurred; but they must be careful not to put on the concern any charges that could be avoided. He did not want them to suppose that, because they had secured profits in the past, they could begin to play ducks and drakes with the revenue of the undertaking. The minutes were adopted.

A New Pumping-Engine at the Ipswich Corporation Water-Works.—A new direct-acting triple-expansion Worthington surface-condensing engine of 100-horse power nominal has been put down at the Ipswich Corporation Water-Works, in place of one of the old engines which has done service for the past 40 years. The new engine is guaranteed to be capable of raising 2 million gallons of water per 24 hours, against a head of 200 feet, which is some few feet more than the height of the Park Road reservoir. It works from both wells, and can be made to supply either the Park Road or Spring Road reservoirs. The engine was supplied by Messrs. J. Simpson and Co.; the contract price being £2600. The occasion of the starting of the new engine was celebrated by Mr. D. Ford Goddard, the Chairman of the Water-Works Committee, giving a luncheon on the premises to his colleagues, the representatives of the engineering firm, and other gentlemen.

The Lead-Poisoning Trouble at Rochdale.—A statement was made on this subject, at the last meeting of the Rochdale Town Council, by the Chairman of the Water Committee (Alderman W. T. Heap). Having mentioned that the Committee had recommended property owners to lay iron pipes, as the Corporation had nothing to do with the services, he said that everything possible was being done to lessen the danger of lead-poisoning. Three years ago the water in the Hamer Pasture reservoir was four times as active on lead as it was at the beginning of this year; and from this fact the Council could form some idea of the good work which the Committee had done. Though they did not consider themselves legally liable for the lead-poisoning, they felt they were bound to do all they could to stop it. The experiments made by the analyst convinced them that, by certain modes of treating the water, they could practically obviate the danger. They decided tentatively to experiment with whiting; and some was put in the Hamer Pasture reservoir. The result had been satisfactory; and probably the Committee would put in machinery for the purpose of mixing the whiting with the water in a proper way. The filter-beds at Spring Mill would be in use in a short time; and they would also materially benefit the water.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

An exceedingly satisfactory year's working at the Hamilton Corporation Gas-Works, for which every credit is due to the Manager (Mr. W. Ewing), concluded in March last. After his appointment, Mr. Ewing, it will be remembered, had a costly scheme of proposed improvements shelved, and introduced a setting of his own design, which has worked admirably. During the past year 7296 tons of coal were carbonized, which, though 219 tons less than in the preceding year, yielded 10,137,100 cubic feet more gas. There was also an increased yield of 60,263 gallons of tar and liquor, and of 668 tons of coke. The price realized for these was, however, less than that received in 1892 by £1218; the prices having been reduced from 9s. 9d. and 10s. 1d. for tar and liquor to 3s. 7d. and 4s. 9d.; and from 6s. and 6s. 3d. for coke to 5s. and 5s. 5d. The average per ton for residuals was 4s. 4d., as against 5s. 0½d. As against this, however, the price of coal was 9s. 6½d., compared with 12s. 5d. in 1892. Gas sold realized £1228 more; and, taking everything into account, the Commissioners have been able to come out with a profit of £2420. Of this sum, £1000 is to be placed to the depreciation account; and the balance enables a reduction to be made in the price of gas, as to which the Commissioners have taken a month to consider whether it will be 3d. or 5d. per 1000 cubic feet. It will be observed that the comparisons are with the year ending in March, 1892, the reason for which is that 1893 was broken in the middle by Mr. Ewing taking up his duties, and the results were thereby disturbed. For instance, he at once raised the yield of gas per ton from about 8000 cubic feet to 10,000 feet. In April of last year, Mr. Ewing's new retorts were brought into full use; and the yield of gas per ton has risen to 10,555 cubic feet. Out of 425 tons 13 cwt. of coal carbonized in that month, there was obtained 4,486,100 cubic feet of gas, 34,183½ gallons of tar and liquor, and 201 tons 3½ cwt. of coke. The cost of gas into the holder, including materials and labour, was 5d. per 1000 cubic feet; and the curious result is brought out that, as compared with April two years ago, had the same price been obtained for residuals, the gas would have been sent into the holder for nothing. Had Mr. Ewing not stopped the large extension proposed, the capital of the undertaking would have been more than doubled. Of course, extension will have to be faced some time, and particularly in the matter of storeage. At present the storeage capacity is only 250,000 cubic feet, yet the maximum daily output last winter rose to 438,000 cubic feet. With careful management, however, an ample supply of gas was kept up. While all this has been accomplished, there has been no attempt to starve the works in the matter of labour. The stokers have been working on the eight-hour system for three years; and just now their wages have been increased from 4s. 9d. and 4s. 11d. to 5s. and 5s. 6d. per day. This is a record with which any gas manager might be gratified.

Notwithstanding the fears which have been expressed in some quarters that the multiplication of oil-gas processes would lead to such a rise in the price of oil that it would soon be found cheaper to use coal, there does not as yet appear to be any justification for the feeling of nervousness. The truth is, of course, that it is not so much the quantity of oil which will be used in gas-works that will affect the oil market, as it is the supplies which are brought in from foreign countries. Where home producers will benefit will be that they will get a ready market at their own doors for an article which does not need so much refinement as if they required to make all their product into burning oil; and they will thus save cost in preparation, and have two outlets instead of one, which will enable them to clear off their stocks more readily. So far as can be foreseen, until oil processes become so common abroad as to limit the supply to this country, it does not appear as if a material rise in price will be experienced. At all events, it has not come yet. The Broxburn Oil Company, one of the largest and most prosperous of the Scotch Companies, have this year been unable to pay any dividend. The Oakbank Oil Company are in a like position. In their report, the Directors say: "It is with satisfaction that they note the growing demand for oil for gas enriching purposes; the more so that the oil used has long been difficult of sale and low in value. No large increase in the price of that oil is looked for; but any increase may be sufficient to make up for any falling off in the value of other oils, which probably will take place through the growing and keener competition that is offered by American and Russian producers." This is reassuring, and should, for the time being, satisfy those who are holding back from the adoption of oil processes on account of prospective rises in the price of oils.

A singular conflict has arisen in the Sheriff Court of Banffshire, between the Town Council of Cullen and the Cullen Gaslight Company. The Company sue the Council for £45 18s. 11d., as the amount incurred for gas supplied to the public lamps for the year ending in March, 1893; and the Council resist payment, on the ground that Mr. W. L. Taylor, who was Secretary to the Gas Company, was also the Treasurer of the burgh, and that, in his capacity of Secretary, he took advantage of himself as Treasurer, and overcharged the burgh, for the year ending in March, 1892, to the amount of £36 12s. 8d., which amount they claim to be entitled to set off against the account sued for. They offered to prove their allegation; but the Sheriff-Substitute refused to allow a proof. On appeal to the Sheriff-Principal, however, the decision was reversed; and the case has been sent back for proof. The Sheriff says that no one would suspect Mr. Taylor of dishonesty; but it is perfectly plain that the two positions were absolutely inconsistent, and that a settlement of accounts made under such circumstances was entirely worthless and incapable of any legal effect whatever. The case being still *sub judice*, it is impossible to write upon the merits of it; but the Sheriff's judgment is open to criticism; and I would like to point out where I consider there is a weakness in it. His Lordship seems to assume that Mr. Taylor rendered the Gas Company's account to himself, and paid it to himself. If such a thing is possible in Cullen, then the sooner it is put a stop to the better. On the one side, before the Sheriff's assumption can be held to be right, it would be necessary to prove that there was no check on the amount consumed, or that Mr. Taylor falsified the figures in the books of the Company; and on the other side, it would be necessary to establish that the Town Council were negligent in not requiring their Treasurer to submit accounts to them before payment, or that they passed accounts without examining them. I should say the circumstances are sufficiently strong to justify the Gas Company appealing to the Court of Session.

A writer in a local newspaper points out the extraordinary fact, deduced from the parliamentary returns, that in the Corporation Gas-Works at Lockerbie only 5524 cubic feet of gas is produced per ton of coal carbonized. His figures are correct, so far as the return goes. It is certainly a very low quantity to derive; and his request for some explanation is reasonable. The Corporation are in difficulties over their gas undertaking. It is known that the works are not in the best condition; and if this be the explanation of the low yield, the remedy should not be far to seek. Any outlay which might be made upon the improvement of the works could not cost so much for interest and repayment of loan as the amount of the present annual loss upon the undertaking. As the writer points out, as compared with other five towns named, the Lockerbie Police Commissioners only get 66 cubic feet for every 100 feet obtained in the other towns. Subject to any explanation which may be made, I should say that, if the Commissioners got the usual return from their coal, they should have no need for the gas contingent rate which they have imposed.

The sulphate of ammonia market is reported to be strong; the quotations being, for spot, £13 6s. 3d. per ton—a rise of 7s. 6d. per ton—and for forward delivery, from £13 10s. to £13 12s. 6d. per ton.

The Strathaven Gas Company have paid a dividend for the past year of 10 per cent., and have reduced the price of gas by 5d. per 1000 cubic feet. The Company supply gas to the public lamps free.

The Denny Police Commissioners have entered into a contract for the sale of the ammoniacal liquor produced at the gas-works during the next twelve months. The price is 4s. per 100 gallons, which is an increase upon the price for the current year.

The Corporations of Brechin and Montrose seem to have both been smitten by a species of electrical rabies. Both had the subject of introducing electric light into their respective towns before them this week. In each case the Corporation is receiving the attention and the guidance of the Scottish House-to-House Electric Lighting Company—the Company which recently started an installation at Coatbridge. Members of the Corporations have visited the Coatbridge installation; and, of course, they are enamoured of it. In Montrose they have gone further, for on Thursday they had representatives of the House-to-House and the Brush Companies inspecting the town, with a view to advising them; and the advice they received was that a better place for electric light could not be got. What it is which constitutes the special adaptability of Montrose for electric lighting, I am not much concerned with; but when it is stated, as it was in both places, that electricity at 6d. per unit is cheaper than gas, I consider it time to say something on the other side. The statement is made on the strength of the assumption that six units of electricity are equal to 1000 cubic feet of gas. This assumption, as I showed in the JOURNAL for Jan. 23 last, in connection with the Stirling proposal, is wrong. It is twelve units which are equivalent to 1000 cubic feet of gas, for ordinary lighting. When, therefore, it is said that in Montrose electricity would cost 3s., as compared with 4s. 7d. for gas, I feel bound to point out that the cost of electricity would be 6s., as compared with 4s. 7d. for gas; and in Brechin, that electricity at 5d. per unit would cost 2s. 6d., as compared with 3s. 9d. for gas, that the cost would be as 5s. to 3s. 9d. It is not out of place to ask why, if Montrose be such an ideal town for electricity, it should be necessary to charge 6d. per unit in it; while Brechin, which Nature does not seem to have favoured so highly, should be able to get it for 5d. per unit. This is one of the mysteries of the subject. The House-to-House Directors are anxious to get both towns to co-operate with them in procuring Provisional Orders. What may happen in Montrose, I cannot say, because the Town Council have yet to deliberate on the matter. In Brechin, a motion that they should proceed with an application for a Provisional Order was not seconded; and notice was given of a motion for the appointment of a Committee to make inquiry. So far, therefore, not much progress has been made in either town.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 12.

Sulphate of Ammonia.—The market is passing strange; for it has taken a turn which is surprising everybody. Instead of the gloom deepening, when it was ascertained about a week ago that the April shipments were about 2000 tons further behind those of last year (making a deficiency of nearly 8000 tons during the four months), an upward movement has actually set in; and quotations are about 5s. per ton higher than at the beginning of the week. It is difficult to explain the altered conditions of the market, beyond the eager buying of all dealers and speculators—a circumstance which makes it perfectly clear that the cheap sales previously reported were for "bear" account. Should the consumers themselves now appear on the scene as well—which they most likely will when they find their anticipations of lower prices scattered to the winds—prices may again reach a much higher level than at present expected; and the strangest part of it all is that it is impossible to discover anything like the stocks supposed to exist on account of the reduced shipments. From present proceedings, it must be concluded that, in this instance, the holidays will not have a dulling influence on the market; and perhaps the difficulty of deliveries in consequence of them may have something to do with the eager buying. Nitrate is very dull, at 9s. 10½d.

LONDON, *May* 12.

Tar Products.—The feature of the week is the unexpected improvement in the value of pitch. This is all the more remarkable as coals continue to fall day by day; and colliery owners are all round crying out that they are losing money at present prices. It looks as if the lessened production of tar is making itself felt, or that the use of pitch is increasing. Benzols are flat; and although the nominal price is 1s. 1d., business has been done at 1s. 0½d. less 2½ per cent.; while buyers in many cases only offer 1s. per gallon. Fifties are also

dragging—1s. 4d. being difficult to obtain; while a sale is mentioned of a small quantity at a country port at 1s. 3½d. There is a fairly good demand for solvent; but the low price of benzol is reflecting itself on this product. Creosote and common oils continue a drug. Carbolic acid is moderately firm. Anthracene is strong at Committee's price. To-day's values are: Tar, 12s. to 16s. Pitch, 27s. to 28s. Benzol, 90's, 1s. 1d.; 50's, 1s. 4d. Solvent naphtha, 1s. 2d. Creosote, 1¼d. Creosote salts, 25s. Toluol, 1s. 8d. Cresylic acid, 1s. 1d. Crude benzol naphtha, 30 per cent., 5½d. Carbolic acid, 60's, 1s. 8d. Anthracene, "A," 1s. 1d.; "B," 10½d.

Sulphate of Ammonia has taken quite a sudden turn for the better; for while it was difficult to sell a week ago at £13 less 3¼ per cent., 5s. to 10s. per ton advance can be obtained for delivery this and next month. The make is rapidly falling off; and, if it be as is supposed, that dealers have important orders up their sleeves, the next few months should see continually improving prices. Gas liquor is offered at 9s. to 11s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The position throughout the coal trade of this district remains without any very material change; the demand all through being excessively dull. Three and a half to four days continues the average; whilst stocks go on accumulating rapidly. With the exception of one isolated case in North Lancashire, the Lancashire Coal Sales Association are, however, holding on to late official rates; and the leading firms of the Manchester district are also keeping to late quotations. But in the open market there is excessively keen competition; and coal coming in from other districts is offered extremely low. With regard to gas-coal contracts, I understand that a conference of representatives of Lancashire and South Yorkshire collieries was held in Manchester last Tuesday, with a view of deciding upon the course to be taken with such contracts as have so far come upon the market. The proceedings were, of course, strictly private; but from what I can gather generally, there does not seem to be much prospect of their being able to hold on to the advance of 1s. per ton upon last year's prices, as in one instance at least tenders, I hear, have been sent in which come within 6d. of last year's rates. There is, however, nothing yet really definite upon which to base what are likely to be the actual prices ruling for gas coal; and quotations at the pit mouth generally remain about the same as those last given. Best Wigan Arley now averages about 11s. to 11s. 6d., with 12s. quoted in special cases; Pemberton four-feet and seconds Arley, 10s. to 10s. 6d.; whilst for common house coals and gas-making qualities 8s. to 8s. 6d. per ton, and steam and forge coals 7s. 6d. to 8s. per ton, are about the current figures of the Lancashire collieries. Coal from Derbyshire, Staffordshire, and Yorkshire, however, is offering here in many cases at considerably under what Lancashire colliery proprietors are in a position to entertain. There have been recently several important secessions from the Coal Sales Association; while I understand that there has also been some breaking away from the Coalowners' Federation. Any movement for reducing wages, therefore, is scarcely likely to secure the same support as it did last year. The shipping trade continues in a very depressed condition; and exceptionally low prices are taken for common coal, delivered at both the ports on the Mersey and the Partington tips on the Manchester Ship Canal. Engine classes of fuel are fairly steady at late rates; but there is no scarcity of supplies, and through-and-through coal is offered freely at very low figures. At the pit mouth, common slack averages 5s. to 5s. 6d.; best sorts of slack are quoted at 6s. to 6s. 6d.; and through-and-through coal can be readily bought at 6s. 6d. to 7s. per ton.

Northern Coal Trade.—The first demand for coal for the Baltic ports being now satisfied, there is a slight lull in the coal trade; and prices are, generally speaking, slightly easier. Best steam coal is still quoted at 10s.; second qualities, 9s.; and steam smalls, 4s. 9d. per ton f.o.b.; but there have been sales a little below these prices, to procure ready trade. Gas coals now meet a slow sale locally; the consumption being nearly at its lowest. But there is a better demand for export; and some of the collieries near to navigable waters are sending out large supplies. There is very little alteration in the price of gas coals. For odd cargoes 7s. 3d. per ton f.o.b. is quoted; though there are one or two collieries, producing under special circumstances, who ask as high a price as 8s. per ton. Coke is sold in lessened quantities for export; the price varying, according to quality, from 13s. to 14s. per ton f.o.b. But the consumption at the local and north-western blast furnaces is increasing. Gas coke is now in very limited production, compared to what it was five months ago; and stocks are lower. There is no alteration reported in the prices of gas coke.

Scotch Coal Trade.—This week has been an unsatisfactory one, so far as the volume of trade is concerned. In the beginning of the week, not a few of the miners were idle, in obedience to the resolution of the Glasgow conference of delegates with regard to the proposed reduction of 1s. per day. They were, however, unable to maintain that position; and a pretty general movement towards returning to work set in. Then there came the advice from the Federation in London to go in in the meantime; and to ask a conference with the masters, with a view to getting the reduction made 6d. instead of 1s. Work has accordingly been resumed generally. Unfortunately, orders are not plentiful; and as reports from England speak of large stocks, there is likely to be a good deal of broken time, even with the reduced wage. Except for ell, there is little demand, though inquiry is being made for nuts for winter use abroad. The prospect is not cheering for either masters or men. Compared with what obtained in May of last year, the men's wages are 2s. per day more, and the general quotation for coal is 1s. 6d. per ton dearer. The prices quoted are: Main, 6s. 9d. to 7s.; ell, 8s. 3d. to 8s. 6d.; splint, 7s. 9d.; and steam, 9s. to 9s. 3d. per ton f.o.b. Glasgow. The shipments still keep high, on account of old contracts being worked off. For the week, they amounted to 177,037 tons—an increase of 23,744 tons as compared with the preceding week, and of 21,061 tons as compared with the corresponding week of last year. For the year to date, the total shipments have been 2,461,788 tons—an increase over the corresponding period of last year of 345,439 tons.

Sales of Stock and Shares.—A small quantity of stock of the *Gosport Water Company* was publicly sold last Tuesday week, and realized from £44 10s. to £45 per £20 lot, and £57 10s. per £25 lot——A parcel of £5 shares (£4 paid), 1883 issue, in the *Portsmouth Water Company* has changed hands at £9 2s. 6d. each.——Yesterday week Mr. H. Gott sold at Pudsey £300 of "B" stock in the *Harrogate Gas Company* at £250 per cent.; three lots of £300 each of new consolidated stock in the *Pudsey Gas Company* at £192, £193, and £194 15s. respectively, and £152 13s. 4d. at the last rate.——Among a number of shares sold by auction at Southsea last Tuesday were a "C" share in the *Portsea Island Gas Company*, which sold for £101, and ten "A" and "B" shares, which realized £115 10s. and £107 10s. respectively.

The Working of the Ilkeston Corporation Gas Department.—We learn that the paragraph on the above subject in last week's JOURNAL (p. 848), which was prepared from information obtained from a local source, was not strictly in accordance with the facts. The statement made by the Chairman of the Gas Committee was really in answer to a question put casually to him as to what might be available from the Gas Department towards the district rate—the making of which for the half year was under consideration; and his reply was that not much relief must be expected, in view of what the Committee had had to pay for coal. As a matter of fact, the accounts for the past financial year are not yet complete; and we have reason to believe that, although the Committee have, in common with others, been "hard hit" over the coal business, when they appear they will not present quite so unsatisfactory a result as would be expected from our paragraph. We may, therefore, congratulate both the Gas Committee and their Manager (Mr. F. C. Humphrys).

Manufacturing Results at the Halifax Gas-Works.—Two or three matters of interest respecting the operations at the gas-works were referred to at the last meeting of the Halifax Corporation. In his remarks in moving the adoption of the Gas Committee's minutes, Alderman Brook claimed that they were manufacturing gas at nearly 10 per cent. less per 1000 cubic feet than any other Corporation in England, and that, taking the last three years, their saving under this head was £12,000 over other corporate towns. The motion having been seconded, Alderman Tattersall remarked that, according to the minutes, the Gas Engineer (Mr. T. Holgate) had reported that the stoking-machine which had been introduced was being worked at a reduction in cost of wages of £13 15s. per week. He wished to ask what the cost of the machine referred to was, what the interest on the capital would amount to per week, what would be the depreciation of the machine, and what was the cost of maintaining it, to set against the reduction of £13 15s. Alderman Brook, in replying, reminded the members that at present the machine was only in operation in one-fourth of the upper retort-house. When, he said, the whole house was in proper order to receive the machines, the saving would amount to £52 per week. This would cover all outlay, interest, and everything else. Alderman Tattersall further observed that from 1871 to 1888 the production of gas had grown to the extent of 150 per cent., with an augmented capital of 30 per cent. Since 1888, however, the capital had been increased 30 per cent., yet the productive results had only amounted to 15 per cent. He asked whether the Chairman of the Committee could tell him where the discrepancy in these figures came in. Alderman Brook said he could not reply off-hand to the inquiry. The Deputy-Mayor, however, remarked that it had been found that 9500 cubic feet of gas was quite sufficient to make from a ton of coal. Other corporations might, perhaps, get a larger yield; but at Halifax they went in for quality. It may be added that Mr. Holgate has been instructed to prepare plans for, and estimates of the cost of, plant for the production of oil gas.

Exhibitions of Gas Appliances.—Among the successful exhibitions of gas appliances recently held must be included that of the Winchester Water and Gas Company, who secured the co-operation of Messrs. Fletcher, Russell, and Co., Limited, in making, in the St. John's Rooms, in that city, a very attractive display. The exhibition was quite a novelty for Winchester; and its value was much enhanced by a series of excellent lectures on cookery delivered by Miss Edden. The Company's Manager (Mr. F. G. Dexter) had a representative collection of burners, old and new, in order to demonstrate to the visitors the improvements which have been made in recent years.——The Davis Gas-Stove Company, Limited, continued their exhibition of gas appliances in the Albert Hall, Portsmouth, last week, with Mrs. Hunter's assistance; and they held an exhibition in the Public Hall, Wigan, from Tuesday to Friday last. Mrs. Springthorpe gave lectures on cookery.——Under the auspices of the Elland-cum-Greetland Gas Company, Messrs. C. Wilson and Sons, of Leeds, held a successful exhibition of their appliances in the Town Hall, Elland, last week. The arrangements, which were under the supervision of the Company's Manager (Mr. R. Porter) included a course of cookery lectures by Miss Grace Holroyd.——Messrs. Wilson have lately been exhibiting at Broughty Ferry, in conjunction with Messrs. R. and A. Main; Miss Burden giving lectures.——Last week, Messrs. Main joined Messrs. John Wright and Co., Limited, in an exhibition held under the auspices of the Gas Committee of the Stockport Corporation in the Temperance Hall, Thornaby; Mrs. Pilcher giving interesting cookery demonstrations afternoon and evening.——In the week ending on the 5th inst., Messrs. W. Parkinson and Co. held a very successful exhibition in the Town Hall, Hitchin; and one last week in the Corn Exchange, St. Albans. Miss Edith Sanderson lectured to large audiences and gave practical demonstrations on cookery at both places.——A most successful exhibition of gas cooking, heating, and lighting appliances has been held during the past fortnight by the Lea Bridge District Gas Company at Walthamstow. Gas cooking ranges, fires, &c., were exhibited by Messrs. Fletcher, Russell, and Co., and lectures on cooking by gas were delivered twice daily by Miss Mackay. The lighting section of the exhibition was furnished by Messrs. Hulett and Co., Limited, the Incandescent Gas-Light Company, Limited, and Messrs. Gilbey and Co. The whole of the arrangements were carried out by Mr. W. Thorman, the Company's Engineer.——In the Albert Hall, Swansea, last week, the Swansea Gas Company held an exhibition of Messrs. Arden Hill and Co's. gas cooking appliances; Mrs. Broughton giving free cookery lectures.

Widnes Corporation Gas and Water Department.—It was reported at the meeting of the Widnes Town Council last Tuesday that the profit and loss account of the Gas and Water Committee showed a net profit on the gas-works of £1149, and on the water-works of £601.

The Guiseley Local Board and the Water-Works.—A meeting of the ratepayers of Guiseley last Wednesday ratified the agreement entered into by the Local Board with the Water Company for the purchase of their plant, "providing the Company are in a position to transfer to the Board all the sources from whence they derive the present supply of water."

The Sale of the Runcorn Water-Works to the Improvement Commissioners.—A general meeting of the Runcorn Water Company was held yesterday week, for the purpose of passing the accounts on the winding up of the Company. In their report the Directors stated that the revenue account showed the balance of £1288, out of which they recommended a dividend of 5 per cent. per annum free of income-tax. The balance-sheet showed that on capital account there had been received from the Improvement Commissioners purchase-money amounting to £67,500, and bank interest £14—making a total of £67,514. On the payment side were: Mortgages and bond debts, £2400; holders of shares entitled to a preferential dividend, being a sum equal to 28 years' purchase of the amount of such dividend, £24,437; ordinary shareholders on account, £37,500; parliamentary expenses and law costs to March, 1894, £887; accountant's charge in connection with the sale, £105; banker's commission on division of capital, £50; amount transferred from revenue to capital account as depreciation fund, £1000. There was a balance in hand of £903; and on revenue account there was a balance of £1288. The Chairman (Mr. J. Brundrit) proposed the adoption of the report and balance-sheet and the payment of the dividend recommended; and this was agreed to.

The Charge for Gas for Public Lighting at Leeds.—An adjourned meeting of the Leeds County Council was held last Wednesday; and, in moving the adoption of the minutes of the Gas Committee, Alderman Gilston intimated that they were not prepared to accede to the request of the Lamp Committee to be supplied with gas for the public lamps at 2s. 2d. per 1000 cubic feet, instead of raising it to 2s. 4d.—the price charged to the private consumer. He reminded the Council that, owing to the coal strike, they had a deficit on last half-year's working of £12,000; and this was, therefore, hardly the time when the Public Lamp Committee should seek to increase their burdens. They required more capital for the gas undertaking; and though they had received permission to borrow, they were told they would have to repay it in ten or twelve years, and were further notified that they must take sufficient out of their profits to create a working capital. If the prices of residuals had remained at what they were in 1883, the Committee would be able to sell gas at 11d. per 1000 cubic feet less than it was to-day, and make a profit; but their value had gone down, and the £90,000 thus lost to them had had to be made up by the recuperative forces of the undertaking. The resolution having been seconded, Mr. Harland proposed, as an amendment, that the price of gas to the Lamp Committee should remain at 2s. 2d. He said that, when at the last Council meeting the question was referred back, it was quite understood that the Council desired the price to stand as it was; and the Gas Committee ought to have respected that wish. Mr. Pickersgill seconded the amendment, which was supported by Mr. Wilson, who said that the net loss on the year's working was only £5000, and that this did not warrant the Committee in raising the price of the gas. Alderman Gilston, in reply, said there were 10,000 people in the city who had meters, and from whom the gas undertaking did not realize a farthing of profit. There were those, too, who used electric light and did not consume gas, and yet they proposed to release them from a portion of the rate, and make the gas consumers pay it for them. This was very unfair. Eventually the Committee's recommendation was adopted by 24 votes to 15.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 905.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	**GAS COMPANIES.**				£ s. d.
590,000	10	12 Apl.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	„	7½	Do. 7 p.c	10	12—13	..	5 15 4
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
100,000	20	14 Dec.	8	Bahia, Limited	20	10—11	..	14 10 10
200,000	5	11 May	6½	Bombay, Limited	5	5—5⅛	..	5 18 2
40,000	5	„	6½	Do. New	4	4—4½	+⅛	5 15 6
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	217—222	..	5 3 7
180,000	„	„	8½	Do. New	100	167—172	+2	4 18 10
220,000	Stck.	15 Mar.	11½	Brighton & Hove Original	100	210—215	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	107—110	..	4 10 11
320,000	20	29 Mar.	11½	British	20	45—47	..	4 15 10
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	21—22	..	5 6 7
51,510	10	„	8½	Do. 7 p. c.	10	15½—16½	..	5 3 0
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5½—6½	..	3 1 6
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	101—104	..	5 15 5
150,000	20	28 Feb.	8	Cagliari, Limited	20	26—27	..	5 18 6
550,000	Stck.	12 Apl.	12½	Commercial, Old Stock	100	252—257	+2	4 17 3
165,000	„	„	9½	Do. New do.	100	190—195	..	4 17 5
160,762	„	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	132—137	..	3 5 8
800,000	Stck.	14 Dec.	13	Continental Union, Limited	100	234—239	+2	5 8 9
200,000	„	„	10	Do. 7 p. c. Pref	100	205—210	+1	4 15 3
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk	100	105—110	..	4 10 11
486,090	10	31 Jan.	10	European, Limited	10	22—23	..	4 6 11
354,060	10	„	10	Do. Partly paid	7½	15½—16½	..	4 10 11
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	227—232	−1	5 3 6
100,000	„	„	4	Do. B, 4 p. c. max.	100	98—102	..	3 18 5
665,000	„	„	10	Do. C, D, & E, 10 p.c. Pf.	100	273—278	..	3 12 5
30,000	„	„	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	„	„	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	„	„	7	Do. H, 7 p. c. max	100	175—180	..	3 17 9
463,000	„	„	10	Do. J, 10 p. c. Prf.	100	272—277	..	3 12 5
476,000	„	„	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	„	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	„	„	4½	Do. 4½ p. c. do.	100	132—137	..	3 5 8
908,000	„	„	6	Do. 6 p. c. do	100	177—182	..	3 5 11
3,800,000	Stck.	11 May	12	Imperial Continental	100	213-218⅝	+4	5 10 1
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	109—111	..	4 10 1
541,920	20	15 Nov.	5	Monte Video, Limited	20	13½—14½	..	6 18 0
150,000	5	30 Nov.	8	Oriental, Limited	5	5¼—6¼	..	6 8 0
60,000	5	29 Mar.	7	Ottoman, Limited	5	3¾—4¼	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	2 - 2½	..	8 0 0
420,000	100	2 May	6	People's Gas of Chicago— 1st Mtg. Bds.	100	102—107	..	5 12 1
500,000	100	1 Dec.	6	2nd Do.	100	97—102	..	5 17 8
150,000	10	26 Apl.	6	San Paulo, Limited	10	9½—10½	..	5 14 3
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	315—320	..	4 16 11
1,350,000	„	„	12	Do. B do.	100	253—258	..	4 13 0
260,000	„	„	13	Do. C do.	100	262—267	+2	4 17 4
750,000	„	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	153—157	..	3 3 8
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	275—280	..	3 11 5
1,720,252	Stck.	12 Apl.	8	East London, Ordinary	100	223—228	+3	3 10 2
544,440	„	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147—150	..	3 0 0
700,000	50	14 Dec.	8½	Grand Junction	50	114—118	..	3 11 10
708,000	Stck.	28 Feb.	11½	Kent	100	290—295	+2	3 17 11
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	255—260	+5	3 13 1
406,200	100	„	7½	Do. 7½ p. c. max.	100	203—207	..	3 12 5
310,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	132—135	..	2 19 3
500,000	100	14 Feb.	12½	New River, New Shares	100	367—372	+2	3 5 2
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—136	..	2 18 10
902,300	Stck.	14 Dec.	6	S'thwk & V'xhall, 10 p. c. max.	100	161—164	..	3 12 2
126,500	100	„	6	Do. D 7½ p. c. do.	100	147—152	..	3 19 0
1,155,066	Stck.	14 Dec.	10	West Middlesex	100	268—273	+1	3 13 3

*Ex div.

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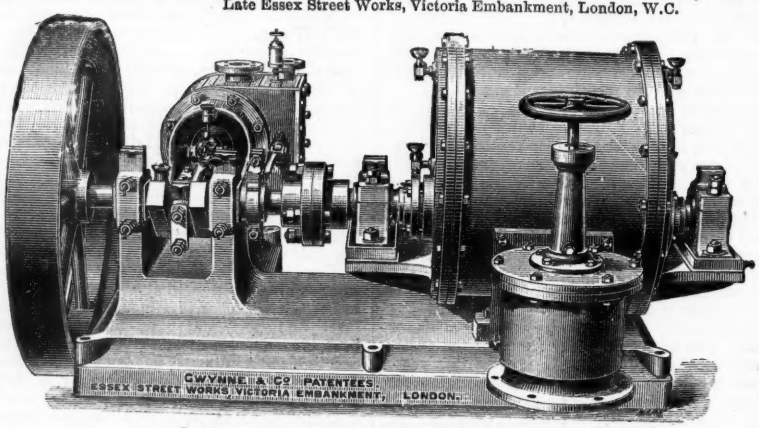

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Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES HYDRAULIC REGULATORS' VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications *re* OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

BRIN'S Oxygen Company, Limited, Westminster. ANDREW STEPHENSON, Agent.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 200 British Gas-Works. [See Advt., p. 875.]
ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C. Telegrams: "Volcanism, London."

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

GAS ACCOUNT-BOOKS, ETC.

THE Advertiser, having had many years' experience in Gas Office Book-keeping, is prepared to supply DRAFT FORMS OF GAS ACCOUNT-BOOKS, &c., hand-ruled to suit special requirements.
Address No. 2380, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Son of a Gas Manager (aged 20), a Situation as an ASSISTANT MANAGER. Understands the routine of a Gas-Works. Could assist in Drawing.
Address No. 2382, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation in Gas-Works. Can take charge of Small Works. Has had charge of such Works Three Years; Six Years' experience.
Address H. BARNES, care of Mrs. Douglas, Manor Road, Braintree, ESSEX.

WANTED, a Manager for a Tar Dis-tillery, with a view to Partnership.
Apply, by letter, giving age, references, and experience, and what capital at disposal, to No. 2381, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, two or three Gentlemen well acquainted with Gas Companies to sell commodity in constant use. State experience, what connection, and what district most suitable.
Apply, by letter, to No. 2375, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

KEGWORTH GAS-WORKS.

WANTED, a Man to manage (single-handed) the above Works. Production about 3 millions. House, with good Garden, Gas, and Coal.
Apply, stating age, wages, and present occupation, to J. A. UTTING, Secretary, Gas Company, Kegworth, near DERBY.

AGENCY (additional) wanted by Advertiser having good connection among Gas Engineers in London and Southern England. Good opportunity for placing new Invention before Gas Managers, or for extending already existing Business.
Address, No. 2385, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SECRETARY TO GAS COMPANY.

THE Guildford Gas Company will, on the 24th of June next, require the services of a SECRETARY, whose duties, in addition to the ordinary duties of a Secretary, will be to superintend, and be responsible for, the laying of all Mains and Pipes, and all work in connection with the Company's Business outside the Company's Premises.
Salary, £250 per annum, no Residence or Extras.
Applications (with Testimonials, not exceeding three in number) to be sent to the Chairman of the Company, 138, High Street, Guildford, on or before the 24th of May next.
The person appointed will be required to give a Bond, with two Sureties, in the amount of £500 for the due performance of his duties.
Gas Offices, Guildford,
May 1, 1894.

TO ENGINEERS AND GAS COMPANIES.

WANTED, for immediate delivery for a Scotch Gas-Works, a second-hand CAST-IRON TANK, 38 ft. to 41 ft. diameter, by 12 ft. to 14 ft. deep, for storing Tar and Liquor Products. Must be in sound condition.
Send price and particulars to No. 2384, care of Mr. 11, Bolt Court, FLEET STREET, E.C.

PURIFIERS.

FOR SALE—Three 6 feet square Puri-fiers, complete with Lifting Arrangement, 6-inch Valves and Connections. Replaced by others of larger capacity. Would sell two.
Apply to F. TURNER, Manager, Gas-Works, CHARD.

JAMES LAWRIE & Co. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 931 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PATENTS, DESIGNS, AND TRADE MARKS.

INVENTIONS Protected by Letters Patent. TRADE MARKS REGISTERED at home and abroad. Advice on all questions relating to above. Handbook gratis.
Apply to J. C. CHAPMAN, Chartered Patent Agent, 70, Chancery Lane, LONDON.

LIQUOR, Tar, and Spent Oxide Wanted. BROTHERTON AND Co., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

AMMONIACAL LIQUOR Wanted. BROTHERTON AND Co., Ammonia Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted. BROTHERTON AND Co., Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted. BROTHERTON AND Co., Chemical Manufacturers' BIRMINGHAM, LEEDS, and WAKEFIELD.

RAMSGATE CORPORATION.

FOR SALE—Two Double-Blade Rotary EXHAUSTERS, equal to 25,000 cubic feet per hour. Makers, George Waller and Co. Removed to make way for larger ones.
Further Particulars on application to
WILLIAM A. VALON,
Engineer.

FOR SALE—Small Gasholder Pillars, CHAINS, WEIGHTS, &c.; also a small GAS-PUMP. The Gasholder has been in use for Ten Years, and has been kept in good repair, and thoroughly painted.
Address GEORGE W. NELSON, Stone Merchant, Southowram, near HALIFAX.

FOR SALE—The Gas Committee of the Borough of Mansfield have FOR SALE four complete BEDS of seven RETORT-FITTINGS, with Tangye's Self-Sealing Mouthpieces, 16 in. by 15 in.; Ascension-Pipes, 6 in. to 5 in.; Arch and Dip Pipes, 5 in.; four D Hydraulic Mains, with four Regulating-Valves; sundry lengths of Foul Mains, and two Valves; fourteen 6-feet lengths of new Clay ⌂ Retorts for above.
The Ironwork has only been in use Twelve Months, consequently it is all in good condition.
For further Particulars and Information, apply to
ARTHUR GRAHAM,
Engineer and Manager.

TENDERS FOR COAL.

THE Directors of the Harlow and Saw-bridgeworth Gaslight and Coke Company invite TENDERS for 700 or 800 tons of good screened GAS COAL, delivered at Harlow free, in quantities of not less than 50 tons.
Tenders to be addressed to Mr. J. E. Taylor, Sawbridgeworth, and sent in on or before June 1, 1894, and to be sealed and endorsed "Tender for Coal."

NEW MILLS LOCAL BOARD.

TENDERS FOR GAS COAL, ETC.

THE New Mills Local Board invite TENDERS for the supply of best screened GAS COAL and CANNEL for the year ending June 30, 1895.
Estimated quantity: 1200 tons (more or less) of Coal and 300 tons (more or less) of best Cannel, to be delivered in such quantities as may be required from time to time at the L. & N. W. or Midland Railway Stations, New Mills.
Further Particulars may be had on application to Mr. E. Jones, the Gas Manager.
Tenders, with Analysis and full Particulars of the Coal and Cannel offered, to be sent in not later than May 26, 1894, to the undersigned, and endorsed "Tender for Gas Coal and Cannel."
TENDERS are also invited for the purchase of the surplus TAR and LIQUOR for One Year ending June 30, 1895.
The Board do not bind themselves to accept the lowest or any tender.
JOHN POLLITT, Clerk.
Town Hall, New Mills,
May 4, 1894.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO., VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1769.
GAS PLANT CEMENT
FOR ALL LEAKAGES.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

TAR.

BELGIAN Engineer, having excellent business connections, and able to furnish the highest references, is desirous of undertaking, for a good firm, the Agency for the SALE of TAR in Belgium.
Address No. 2383, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Widnes Corporation invite Ten-DERS for the supply of about 13,000 tons of GAS COAL (Slack "through and through," or screened Coal), to be delivered at the Gas-Works, Widnes.
Conditions and Forms of Tender may be obtained from Mr. I. CART, Assoc.M.Inst.C.E., Gas Engineer, Widnes.
Tenders, endorsed "Gas Coal," to be delivered to the undersigned on or before the 28th inst.
The lowest or any tender not necessarily accepted.
H. S. OPPENHEIM,
Town Clerk.
Town Hall, Widnes,
May 12, 1894.

CORPORATION OF MACCLESFIELD.
(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the work required to be done in the taking down, and re-erection in another part of the Gas-Works of Four PURIFIERS, CENTRE-VALVE, and CONNECTIONS, together with sundry new portions.
Further Particulars and Form of Tender may be obtained on application to the Engineer at the Gas-Works.
Sealed tenders, endorsed "Purifiers," and addressed to the Chairman of the Gas Committee, Town Hall, to be delivered on or before the 26th of May, 1894.

BOROUGH OF MACCLESFIELD.

THE Gas Committee are prepared to receive TENDERS for the supply of the whole or part of 10,000 tons of the best screened GAS COALS and 1500 tons of CANNEL, to be delivered free at Macclesfield, at such times and in such quantities as shall be ordered. Deliveries to commence on the 1st of August, 1894, and to be completed within a Year.
Forms of Tender and Conditions may be had on application to the Engineer, Gas-Works, Macclesfield.
Tenders sealed and endorsed to be sent in not later than Saturday, the 26th day of May, 1894, addressed to the Chairman, Gas Committee, Town Hall, Macclesfield.
The Committee do not pledge themselves to accept the lowest or any tender.
W. FREDK. TAYLOR,
Town Clerk.
May 9, 1894.

BOROUGH OF MACCLESFIELD.

THE Gas Committee are prepared to receive TENDERS for the supply of the undermentioned Materials required during a period of Twelve Months, commencing the 1st of July, 1894.
(1) The best hand-picked BUXTON LIME, delivered fresh at Macclesfield, free from Dirt and Ashes, in such quantities as may be ordered.
(2) Wrought-Iron lap-welded STEAM TUBES and FITTINGS.
(3) Cast-Iron MAINS and IRREGULARS.
Any further Information required can be obtained on application to Mr. Newbigging, Engineer, Gas-Works.
Sealed tenders, properly endorsed, to be addressed to the Chairman, Gas Committee, Town Hall, Macclesfield, and to be sent in not later than Saturday, the 26th of May, 1894.
The Committee do not bind themselves to accept the lowest or any tender.
W. FREDK. TAYLOR,
Town Clerk.
May 9, 1894.

DUKINFIELD LOCAL BOARD.

TENDERS FOR COAL.

THE above Board invite Tenders for best screened GAS COAL by Noon, on Tuesday, the 22nd inst.

For Specification and Forms of Tender, apply to HARRISON VEEVERS, C.E., Engineer.

Local Board Offices, Dukinfield,
May 7, 1894.

BOROUGH OF EAST RETFORD.

THE Gas Committee of the above Cor- poration invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works during the Year ending June, 1895.

Tenders to be sent in to the Chairman of the Gas Committee, endorsed "Tender for Tar," or "Liquor," on or before the 31st inst.

Any further Information may be had from the undersigned.

J. B. FENWICK, Manager.

Gas and Water Office, Retford,
May 8, 1894.

BOROUGH OF EAST RETFORD.

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for the supply of 4000 tons of best screened GAS COAL, to be delivered during the Year ending June, 1895.

Sealed tenders to be sent in to the Chairman of the Gas Committee on or before the 31st inst., endorsed 'Tender for Coal."

The Committee do not bind themselves to accept the lowest or any tender.

Any further Particulars may be had from the undersigned.

J. B. FENWICK, Manager.

Gas and Water Office, Retford,
May 8, 1894.

TENDERS FOR GAS COAL.

THE Brentwood Gas and Coke Company invite TENDERS for the supply of about 3500 tons of screened GAS COAL in Trucks at Brentwood Railway Station (G.E.R.) at per ton, to be delivered in the following quantities the second week of each month: June, 140 tons; July, 150 tons; August, 200 tons; September, 250 tons; October, 350 tons; November, 460 tons; December, 520 tons; January, 430 tons; February, 330 tons; March, 280 tons; April, 210 tons; and May, 180 tons.

Tenders (with analysis of the Coal to be supplied) and terms for monthly payments to be sent to the undersigned on or before the 19th inst.

The Directors do not bind themselves to accept the lowest or any tender.

C. A. FIELDER, Secretary.

Brentwood, May 3, 1894.

BUXTON LOCAL BOARD.

TENDERS FOR TAR AND LIQUOR.

THE Buxton Local Board invite TENDERS for the purchase of the surplus TAR and LIQUOR produced at their Works in Ashwood Dale, for One, Two, or Three Years, commencing from the 30th of June next.

Further Particulars and Forms of Tender to be obtained of Mr. G. Smedley, Gas Office, Buxton.

Tenders, endorsed "Tender for Tar and Liquor," to be addressed to the Chairman of the Gas Committee, and delivered not later than Twelve Noon on the 19th day of May.

The Board do not bind themselves to accept the highest or any tender.

By order,
JOSIAH TAYLOR, Clerk.

Town Hall, Buxton,
May 4, 1894.

BUXTON LOCAL BOARD.

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for the supply of good GAS COAL, for One or more Years, at the rate of about 1500 tons per annum, to be delivered at their Siding (on the Midland Railway) in Ashwood Dale, Buxton.

Tenders, endorsed "Tender for Gas Coal," addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall not later than Noon on the 19th day of May.

Forms of Tender and other Particulars may be obtained of Mr. G. Smedley, Engineer, Gas Office, Town Hall, Buxton.

The Board do not bind themselves to accept the lowest or any tender.

By order,
JOSIAH TAYLOR, Clerk.

May 4, 1894.

LINCOLN CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Gas Committee of the Corporation of Lincoln are prepared to receive TENDERS for the purchase of the surplus TAR and the whole of the AMMONIACAL LIQUOR produced at their Works during the period of One Year, commencing on the 1st of July, 1894.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Residuals," must be delivered at the Gas Offices, Lincoln, on or before the 28th inst.

The Committee do not bind themselves to accept the highest or any tender.

Information as to quantities and other particulars may be obtained of the undersigned.

JNO. CARTER, Manager.

Gas-Works, Lincoln,
May 5, 1894.

THE Camborne Gas Company, Limited, invite TENDERS for about 1750 tons of COAL, delivered f.o.b. to the order of the Company, between June, 1894, and June, 1895.

Sealed tenders, endorsed "Tender for Coal," to be addressed to the undersigned, on or before the 21st inst.

The Directors do not bind themselves to accept the lowest or any tender.

W. BAILEY, Secretary.

Camborne, May 9, 1894.

THE Directors of the Petworth Gas Company invite TENDERS for the supply of 700 tons of good GAS COAL, to be delivered free at Petworth Station (L.B. & S.C.R.), when required, commencing in September.

Sealed tenders, endorsed "Coal," to be sent to the Secretary on or before June 1, 1894.

The Directors do not bind themselves to accept the lowest or any tender or supply forms of tender.

C. H. DOWNS, Secretary.

Petworth, May 9, 1894.

TO OXIDE OF IRON MERCHANTS.

THE Corporation of Birkenhead are prepared to receive TENDERS for the supply of 350 tons of OXIDE OF IRON.

Forms of Tender and other Information may be obtained from Mr. T. O. Paterson, Gas Engineer, Gas-Works, Thomas Street.

Tenders, sealed and endorsed "Tender for Oxide of Iron," to be sent in to me not later than Five p.m. on Friday, the 1st of June, 1894.

Deliveries to be made within one month of written instructions from the Gas Engineer.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
ALFRED GILL, Town Clerk.

Town Hall, Birkenhead,
May 9, 1894.

STAINES AND EGHAM DISTRICT GAS AND COKE COMPANY, LIMITED.

TENDERS FOR COAL.

THE Directors of this Company invite TENDERS for the supply and delivery of 6000 tons of EAST PONTOP, NEW PELTON, or other GAS COAL. The deliveries to commence after the 1st of November next, and continue during the period ending on the 30th of September following.

The Company's Works are on the Banks of the Thames.

Forms of Tender, containing further Particulars, may be obtained upon application to the Secretary; and all further Information can be obtained from the Manager, Mr. Thomas Webb, at the Works, Egham.

The Directors do not bind themselves to accept the lowest or any tender.

Sealed tenders to be sent to the undersigned on or before the 5th day of June, 1894.

JOHN ANTHONY ENGALL, Solicitor and Secretary.

Staines, May 5, 1894.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Leek Improvement Commissioners invite TENDERS for the supply of best screened GAS COAL, NUTS, and CANNEL, for One Year from the 1st of July next, to be delivered at the Leek Station on the North Staffordshire Railway, at such times and in such quantities as may be required.

Further Particulars and Forms of Tender may be obtained from the undersigned.

Sealed and endorsed tenders, addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leek, by Four o'clock in the afternoon of Monday, the 21st of May inst.

The lowest or any Tender will not necessarily be accepted.

By order,
C. HENSHAW, Clerk.

Town Hall, Leek,
May 3, 1894.

TAMWORTH GASLIGHT AND COKE COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 2000 tons of best, well-screened GAS COAL, to be delivered between the 1st of July, 1894, and the 30th of June, 1895, in accordance with the Specification.

Forms of Tender and Specification may be obtained from the undersigned.

Sealed tenders to be sent, addressed to the undersigned, not later than June 2 next, endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

WALTER A. SAPEY, Secretary and Manager.

Gas-Works, Tamworth,
May 9, 1894.

TAMWORTH GASLIGHT AND COKE COMPANY.

TO TAR DISTILLERS, ETC.

THE Directors of the above Company invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works for One or Two Years from the 1st of July next.

Coals carbonized: About 2200 tons annually.

Tenders for Liquor to be made either at a fixed price per ton, or on Sliding Scale regulated by the Price of Sulphate.

Sealed tenders, endorsed "Tender for Tar and Liquor," to be sent, addressed to the undersigned, by June 2 next.

Any further Information may be obtained on application.

WALTER A. SAPEY, Secretary and Manager.

Gas-Works, Tamworth
May 9, 1894.

THE Directors of the Kildwick Parish Gas Company invite TENDERS for the supply of the whole or a part of 3000 tons of best screened GAS COAL or NUTS, to be delivered free at Kildwick, during the Twelve Months ending June 30, 1895.

The Coal to be delivered at such times and in such quantities as the Manager may direct.

Tenders to be sent in not later than June 1, 1894.

The lowest or any tender not necessarily accepted.

FRED. H. PICKLES, Manager and Secretary.

Gas-Works, Kildwick,
May 9, 1894.

NORTH CAMP AND FARNBORO' DISTRICT GAS COMPANY, LIMITED.

TENDERS FOR COAL.

THE Directors of the above Company are desirous of receiving TENDERS for the supply of 1000 tons of GAS COAL during the period of One Year from the 1st of July next.

All persons submitting tenders must state the price per ton of 20 cwt. (and whether screened) delivered free to Aldershot Camp Station, South Eastern Railway; and the person whose tender is accepted will be required to deliver the Coal in such quantities as the Directors may from time to time require until the contract is completed.

The Directors reserve the right to divide the contract into two of 500 tons each.

Sealed tenders, marked "Tender for Coal," should be addressed and sent, with latest Analytical Test, to the undersigned not later than Saturday, the 26th inst.

JOHN BAKER, Secretary.

Billiter House, Billiter Street, E.C.,
May 10, 1894.

TENDERS FOR COALS.

THE Directors of the Isle of Thanet Gas Company invite TENDERS for the supply of 3500 tons of the best NEWCASTLE GAS COAL, to be delivered into the Company's Lift Waggon, at their Works at Margate, during the months of June, July, August, and September, in the following quantities (about):—

June	1000 tons.
July	1000 tons.
August	1000 tons.
September	500 tons.

Sealed tenders, endorsed "Coal," to be sent in on or before Thursday, May 24, addressed to the Chairman of the Company.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
THOS. C. FULLER, Secretary.

Gas-Works, Margate,
May 11, 1894.

SUTTON-IN-ASHFIELD LOCAL BOARD.
(GAS DEPARTMENT.)

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the Sutton-in- Ashfield Local Board are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works from July 1, 1894, to June 30, 1895.

Particulars may be obtained on application to Mr. A. Clarke, Gas-Works, Sutton-in-Ashfield, Notts.

Tenders, stating price per ton of 20 cwt. at the Works, or at Sutton-in-Ashfield Railway Station, to be addressed to the Clerk to the Local Board, Local Board Offices, Sutton-in-Ashfield, and marked "Tender for Tar and Liquor," so as to arrive not later than Tuesday, the 29th day of May, 1894.

By order,
G. H. HIBBERT, Clerk to the Committee.

Local Board Offices, Sutton-in-Ashfield, Notts.
May 10, 1894.

CORPORATION OF NOTTINGHAM.
(GAS DEPARTMENT.)

TENDERS FOR COALS.

THE Gas Committee are desirous to receive OFFERS for supplies of COALS, COBBLES, or NUTS, for the period terminating the 30th of June, 1895.

The Large Coals and the Cobbles or Nuts are to be separately delivered, where and as from time to time directed, by and at the expense of the Contractors, upon the Gas-Works Sidings, Great Northern Railway, in the East Croft at Nottingham, and also on the Gas-Works Sidings, Midland Railway, at Radford and Basford respectively, and at and after the rate of one-eighth part of such total quantity in each calendar month, commencing with the month of July next, till the Corporation shall be satisfied with the amount of accumulated Stock, and afterwards at such rate as shall be from time to time directed, till the agreed quantity shall have been delivered.

The Coals, Cobbles, or Nuts are to be the best of their respective kinds, freshly wrought and WELL SCREENED (description, sizes, and inclination of screen to be specified), to be as free as possible from Sulphur, Bats, Bind, Refuse, and Dirt, and shall be weighed (20 cwt. to the ton) upon the Corporation Machines, or upon other such Machines as may be mutually agreed upon.

Payments will be made monthly, if and so long as the contract shall be duly fulfilled.

The Corporation do not bind themselves to accept the lowest or any tender.

Further Information and Forms on which the tenders must be made, may be obtained on application to me, at the General Manager's Office; and the tenders (sealed) specifying the description of Coals, the Seam, and the Pits at which they are to be raised, and stating the prices for deliveries at the several places and in manner and subject to the conditions aforesaid, must be delivered to SIR SAMUEL GEORGE JOHNSON, KT., TOWN CLERK, on or before Saturday, the 19th day of May, 1894.

By order,
WILLIAM REGINALD CHESTER, Engineer and General Manager.

Corporation Gas Offices, George Street,
Nottingham, May 10, 1894.

CAMBRIDGE UNIVERSITY AND TOWN GAS-LIGHT COMPANY.

TO TAR DISTILLERS AND OTHERS.

THE Directors of this Company will, at their Meeting on May 31, be prepared to receive TENDERS for the surplus TAR and the whole of the AMMONIACAL LIQUOR produced at these Works, for a period of One Year, from July 1 next ensuing.

Further Particulars may be had from the undersigned.

O. J. WEEKS,
Manager.

Gas Office, Sidney Street, Cambridge,
May 4, 1894.

SHREWSBURY GASLIGHT COMPANY.

DESIRABLE INVESTMENT.

THE Directors of the above Company invite TENDERS FOR £5000 SHREWSBURY GAS STOCK.

This Stock is entitled to a Maximum Dividend of 7½ per cent., payable half yearly; and the Maximum Dividend has been paid for many Years.

May 20, 1894, is the last day for the reception of tenders.

Forms of Tender, and any other Information, may be had on application to LLOYDS BANK, LIMITED, SHREWSBURY; or to

WILLIAM BELTON,
Secretary.

Gas-Works, Shrewsbury,
May 12, 1894.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

TO THE SHAREHOLDERS.

NOTICE is Hereby Given, that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices, 60, Gracechurch Street, London, E.C., on Tuesday, the 5th of June, 1894, at Twelve o'clock at Noon, for the purpose of receiving the Report of the Directors and the Accounts for the Year ended the 31st of March, 1894, and for the transaction of the General Business of the Company.

One of the Directors, John Birch Paddon, Esq., will retire from office, but offers himself for re-election.

The Auditors, Robert Hesketh Jones and Thomas Guyatt, Esqs., will retire from office, but are eligible for re-election.

The Transfer Books will be closed from the 22nd of May until the day of the Meeting, both days inclusive.

By order,
A. W. COOPER,
Secretary.

60, Gracechurch Street, E.C.,
May 8, 1894.

By Order of the Directors.—£10,700 Perpetual 4 per cent. Debenture Stock and 800 Shares of £10 each in the WEST HAM GAS COMPANY. The standard authorized Dividend on these Shares is 7 per cent., subject to the usual Sliding-Scale Clauses. The last Dividend was 5½ per cent. per annum.

MR. ALFRED RICHARDS will sell the above by Auction, at the Mart, E.C., on Thursday, May 24, at Two o'clock precisely, in lots.

Particulars of the SECRETARY of the Company at the Offices, Union Street, STRATFORD; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

MICHAEL AND WILL'S GAS AND WATER.

Fourth Edition.—In the Press, in One Volume.

THE LAW RELATING TO GAS & WATER.

Comprising the Rights and Duties, as well of Local Authorities as of Private Companies, in regard thereto; and including the Electric Light Acts and Orders. Fourth Edition. By J. SHIRESS WILL, Q.C., M.P.

LOW MOOR BLACK BED

GAS COAL.

YIELD OF GAS PER TON . 10,375 CUBIC FEET.
ILLUMINATING POWER . 17·50 SPERM CANDLES.
COKE . . . . . 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to

GEORGE & JOHN HAIGH,
RAVENS LODGE AND CONYERS' COLLIERIES,
DEWSBURY.

A TRIAL IS RESPECTFULLY SOLICITED.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.,
RAVENSTHORPE, NEAR DEWSBURY.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

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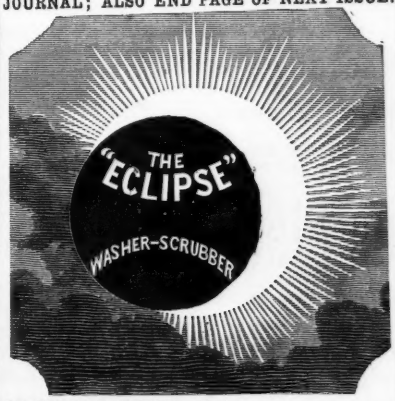
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THE DRUM

FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.

See Advertisement in last and next issue.

SEE ADVT., p. 876 OF LAST WEEK'S JOURNAL; ALSO END PAGE OF NEXT ISSUE.



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JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

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Established 1872.

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FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day. Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
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Newcastle-on-Tyne.
W. H. PARKINSON,
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Lanemark Coal Co.,

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Shipments Promptly and Carefully Executed.

THOMAS TURTON AND SONS, Limited,
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FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
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Engineers and Managers should visit our Works during the months of
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and inspect, in all stages of progress, the
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for the largest Automatic Coal and Coke handling plant in the World.

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3 & 4, Lime St. Square,
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Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for
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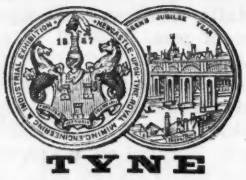

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
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or
E. FOSTER & CO.,
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ENGLISH & SCOTCH CANNELS.
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T. B. KITTEL, SHEFFIELD.

Just published.
With numerous Illustrations and Tables, crown 8vo. cloth, 6s.
THE GAS ENGINEER'S LABORATORY HANDBOOK,
By JOHN HORNBY, F.I.C.
Honours Medallist in Gas Manufacture, City and Guilds of London Institute.
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Worked by the
WEARDALE IRON AND COAL COMPANY, Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

Tudhoe and Sunderland Bridge Gas Company.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.
Gentlemen,
For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.
Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13¼ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. Cowan,
Manager.

For Price, &c., apply to the
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QUAYSIDE, NEWCASTLE-ON-TYNE.

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(Established 1851),
GAS ENGINEERS & CONTRACTORS,
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PAISLEY, N.B.,
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OF EVERY DESCRIPTION.

Sole Agents for Scotland for the Automatic Coal-Gas Retort (Inclined System) Company, Limited.

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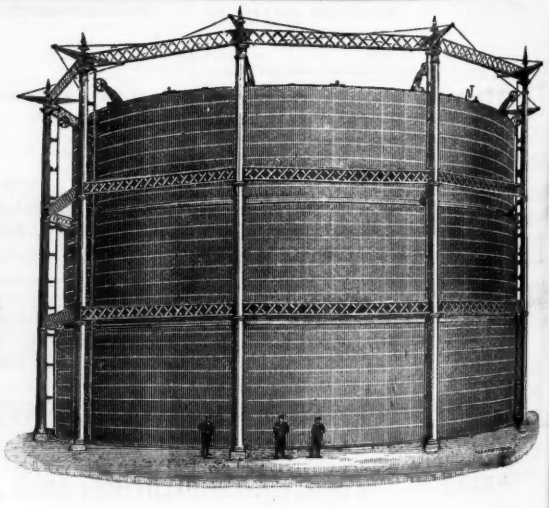

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THE MOST VALUABLE GAS ENRICHER NOW AVAILABLE IN ANY DESIRED QUANTITY.

S. Calvert Ford, Government Inspector at Washington, reports it as giving—

12,553 Cubic Feet of 50-Candle Gas, or 10,460 Cubic Feet of 60-Candle Gas,

AN EQUIVALENT OF 627,650 CANDLE-FEET,

Cargo Shipments to any PORT IN GREAT BRITAIN, on the CONTINENT, or SOUTH AMERICA.

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PLANS, SPECIFICATIONS, AND ESTIMATES SUBMITTED.

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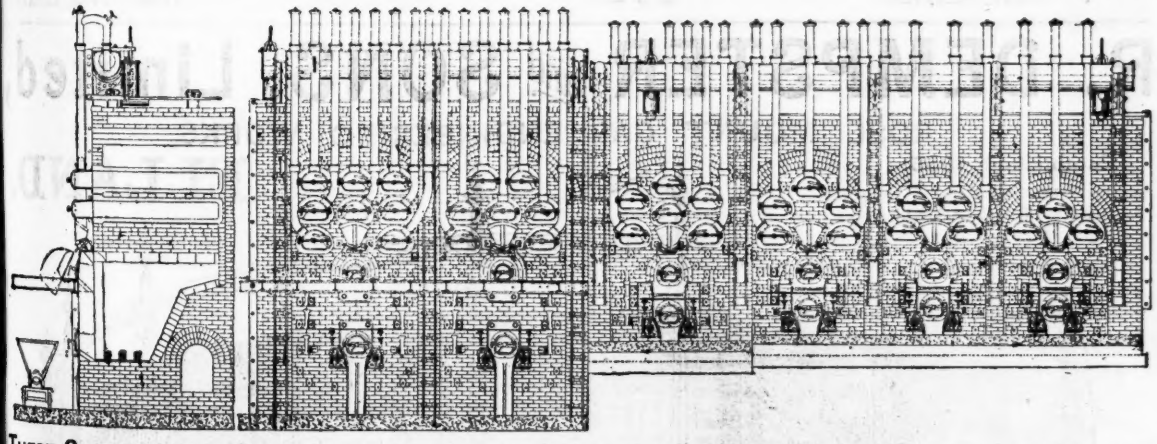
FOR THE ERECTION OF GAS AND WATER WORKS COMPLETE, AND FOR EXTENSIONS AND RENEWALS.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



These Settings are adapted to the requirements of all Gas Companies and Gas Corporations, and have already been very extensively adopted. They are erected upon both the working-stage and shallow-chamber systems and equally satisfactory results are guaranteed in both cases. The Settings have attained to a measure of success and popularity quite unequalled by that of any other within the same space of time. The working results obtained, and the general satisfaction given, are declared in every case to exceed, and in most cases considerably exceed, the Patentee's guarantee. The construction and working of the patent producer and the patent charging apparatus for same are absolutely unique and unrivalled, and are the delight of every stoker; while in every other particular they secure the highest results attainable by any regenerative system, and at a minimum of cost.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings; or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

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Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

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CAST-IRON PIPES
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Pipes, One to Six Inch Bore, kept in Stock. Also a very arge assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

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Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

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Established 1855.
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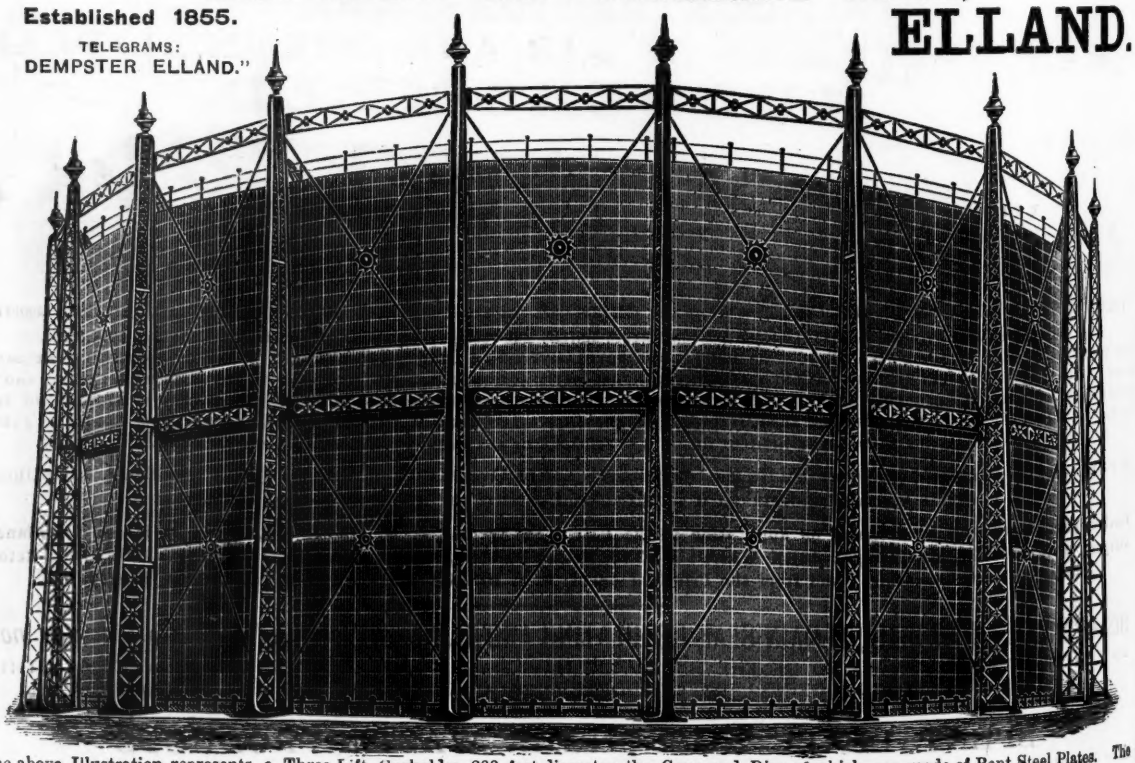

The above Illustration represents a Three-Lift Gasholder, 200 feet diameter, the Cups and Dips of which are made of Bent Steel Plates. The Tripods are of Steel, and braced together by substantial Wind Ties. The whole of the most improved and modern construction.

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CONTRACTORS, AND

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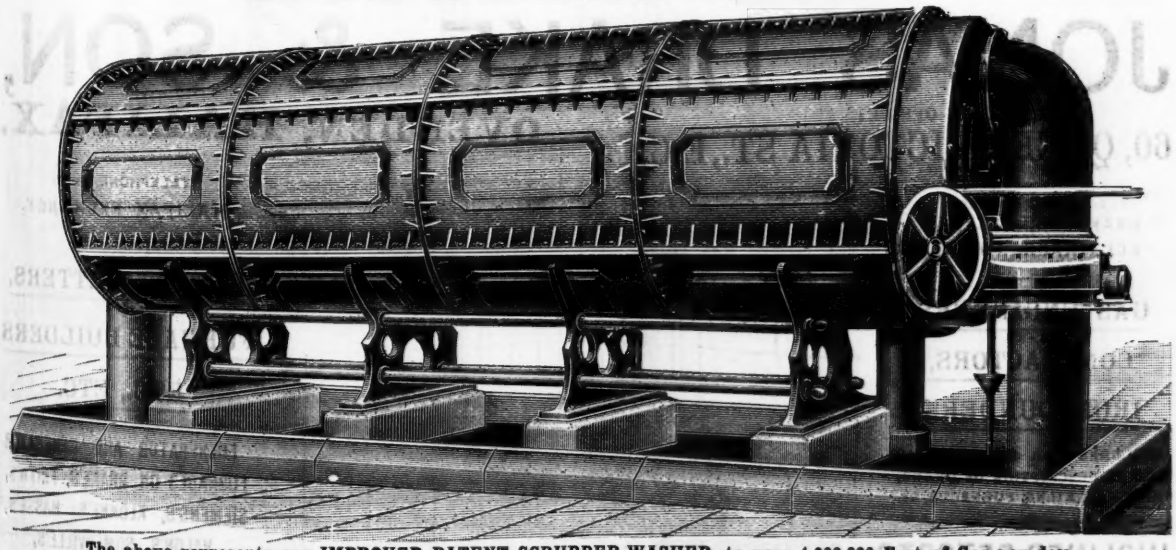

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These Washers are guaranteed to present a larger area of Wetted Surface (size for size) to the action of the Gas than those of any other Maker.

Results unapproached by any other system. *References and full particulars on application.*

PATENT COMBINED EXHAUST REGULATOR AND TAR EXTRACTOR. PATENT RETORT-SETTINGS, CONDENSERS, SCRUBBERS, PURIFIERS, GASHOLDERS, VALVES, AND ALL FITTINGS AND REQUISITES FOR GAS-WORKS.

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General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.
Late General Inspector,
The United Gas Improvement Company, U.S.A.

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Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
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ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

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THE LARGEST GASHOLDER IN THE WORLD

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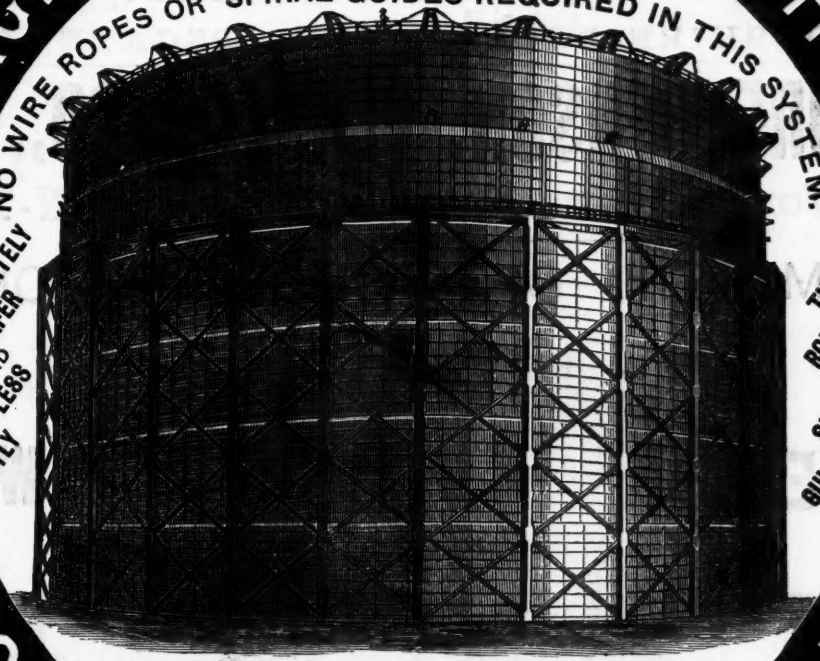
NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.



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CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR

MAKERS OF GAS PLANT OF EVERY DESCRIPTION
ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.
TELEGRAPHIC "GAS, LEEDS."
GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

GAS AND WATER PIPES.

Telegraphic Address: "RITCHIE MIDDLESBROUGH."

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Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

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TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.
LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.
TELEGRAPHIC ADDRESS: "PARKER LONDON."

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A NEW CARBURETTOR FOR ENRICHING GAS IN BULK.

The Carburettors have been doing practical work for the past two years; in many cases doing all the enrichment without the use of Cannel or other rich Coals. The South Metropolitan Gas Company have these Enrichers at all their Stations. The Gaslight and Coke Company have had them in use at some of their principal Works for two years past; and several more are now being fixed at their other Stations. The Carburettors are also in use at several Suburban and Provincial Gas Companies' Works.

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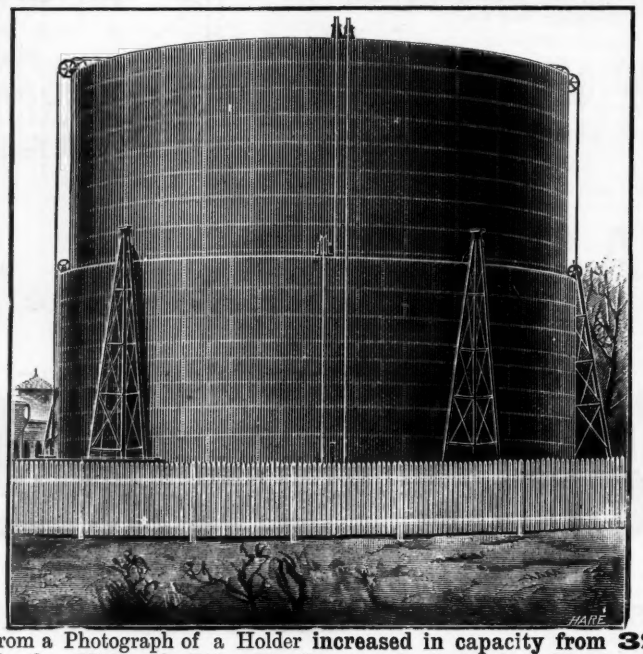

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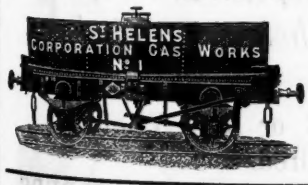

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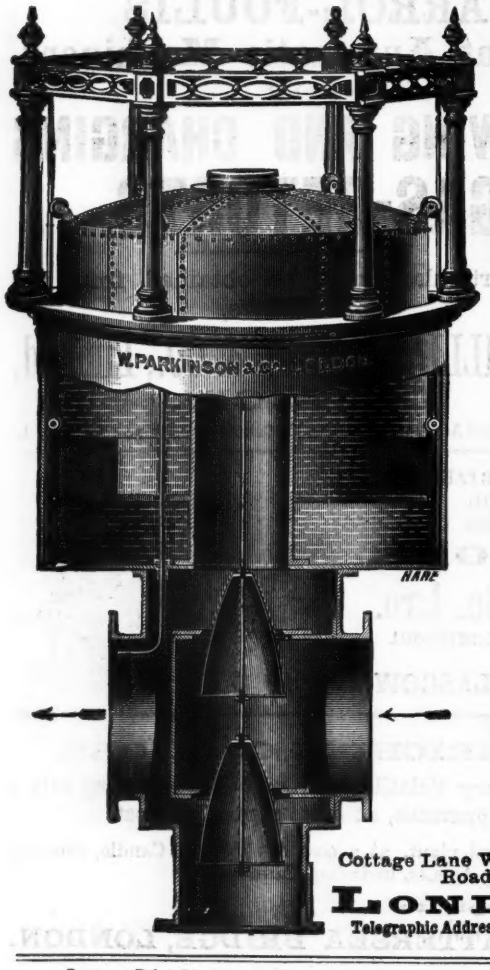

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[See also Advt. p. 854.

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